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Work Plan
for the
Sanitation, Inc. Landfill,
Lewistown, Montana

RECEIVED

JAN 04 1995

Montana Department of Health
and Environmental Sciences
Waste Management Division



DAMSCHEN & ASSOCIATES, INC.

CONSULTING ENGINEERS

• HELENA, MONTANA •



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January, 1995

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prepared by

Damschen & Associates, Inc.
Helena, Montana

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Introduction

Purpose and Scope

This document is a Work Plan for the Sanitation, Inc. landfill in Lewistown, Montana. It is intended to provide hydrogeological background information, a summary of work performed to date, and a proposal for the testing of a long-term vadose zone monitoring system in lieu of ground-water monitoring. While some additional field investigations will need to be performed to augment the data herein, several fundamental geological and hydrogeological concepts have been clearly defined for this facility.

The data obtained during the field investigation include the logs of test borings drilled at and near the facility, as well as results of physical analyses of surface and sub-surface sample.

ing

Location and Operation

The Sanitation, Inc. landfill site is located about 1.5 miles east of the City of Lewistown in the southwest $\frac{1}{4}$ southwest $\frac{1}{4}$ of Section 7, Township 15 North, Range 19 East (Figure 1). It is accessible via Highway 87 (S.R. 200) from Lewistown. The facility is situated atop an elongated ridge that acts as a drainage divide between Boyd Creek to the south and a tributary of Breed Creek to the north.

The facility has been in use for at least two decades, and was simply operated as a dump in previous years. More recent operations have utilized a trench system. The area noted as waste fill on Plate 1 includes all active and past fill areas. The eastern portion of the site was the initial dumping area, and a final cover plan is currently in progress. The trench currently in use on the western side of the facility has approximately two years of useful life.

Geological and Hydrogeological Setting

The only regional geological survey of the area available was that of Calvert (1909). Several other studies of a more localized nature can be found, but none encompasses the Sanitation, Inc. facility. According to Calvert (1909) the surface exposures belong to the Cretaceous-aged Colorado group. This unit comprises predominately drab, fine-grained sediments, including clay shale, siltstone and argillaceous sandstone in the area of Lewistown. The map presented by Calvert (1909) shows the contact of the Colorado group sediments with the underlying Kootenai formation to lie along the southern limit of the landfill. The contact is considered somewhat transitional in nature, but can be clearly defined by the distinct maroon or rust-red coloration of the clay beds within the Kootenai. There are no active faults evident on the property, but locally there appear to be some fault contacts associated with the Tertiary-aged Judith River uplift northwest of the site.

Two distinct ground-water systems appear to exist in the vicinity of the Sanitation, Inc. facility. **Shallow ground** water is hosted by valley-fill sediments in the valleys of **Boyd** and **Breed Creeks**, which flank the landfill to the south and north, respectively (Figure 2). The other aquifer lies within the underlying Kootenai formation sediments (Figure 3). Domestic wells in the area tap both aquifers, with most drawing from the deeper of the two sources.

Figures 2 and 3 depict the approximate ground-water potential elevations in both of the aquifers in the area. Please note that many more well logs were available other than those plotted, but the locational data were insufficient to provide reliable elevation data. Since the well collar elevations are not listed, only those wells that could be located with sufficient precision are included on the maps. All of the well log information for approximately a two-mile radius is included in Appendix A. The logs are keyed numerically and those used on the map are listed in Table 1.

It is clear from an examination of the well logs that the **deep aquifer** is **confined** under considerable head. **Flowing wells** on the south side of Boyd Creek are screened at depths of nearly 150 feet. The shallower aquifer appears to be unconfined, with the exception of wells and seeps noted on the flanks of a tributary to Breed Creek. These are noted on the northeastern portion of Figure 2. The source of these near-surface springs is not clear, but this has no apparent bearing on the ground-water situation at the landfill where the **uppermost aquifer encountered** is the deep aquifer confined within the Kootenai formation sediments. }

*Not differentiated
on map from wells.
Must ref to App A.*



LEWISTOWN

BREED

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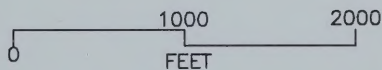
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INC.



KEY:

- ROAD
- - - - - STREAM
- SECTION LINE

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• HELENA, MONTANA •

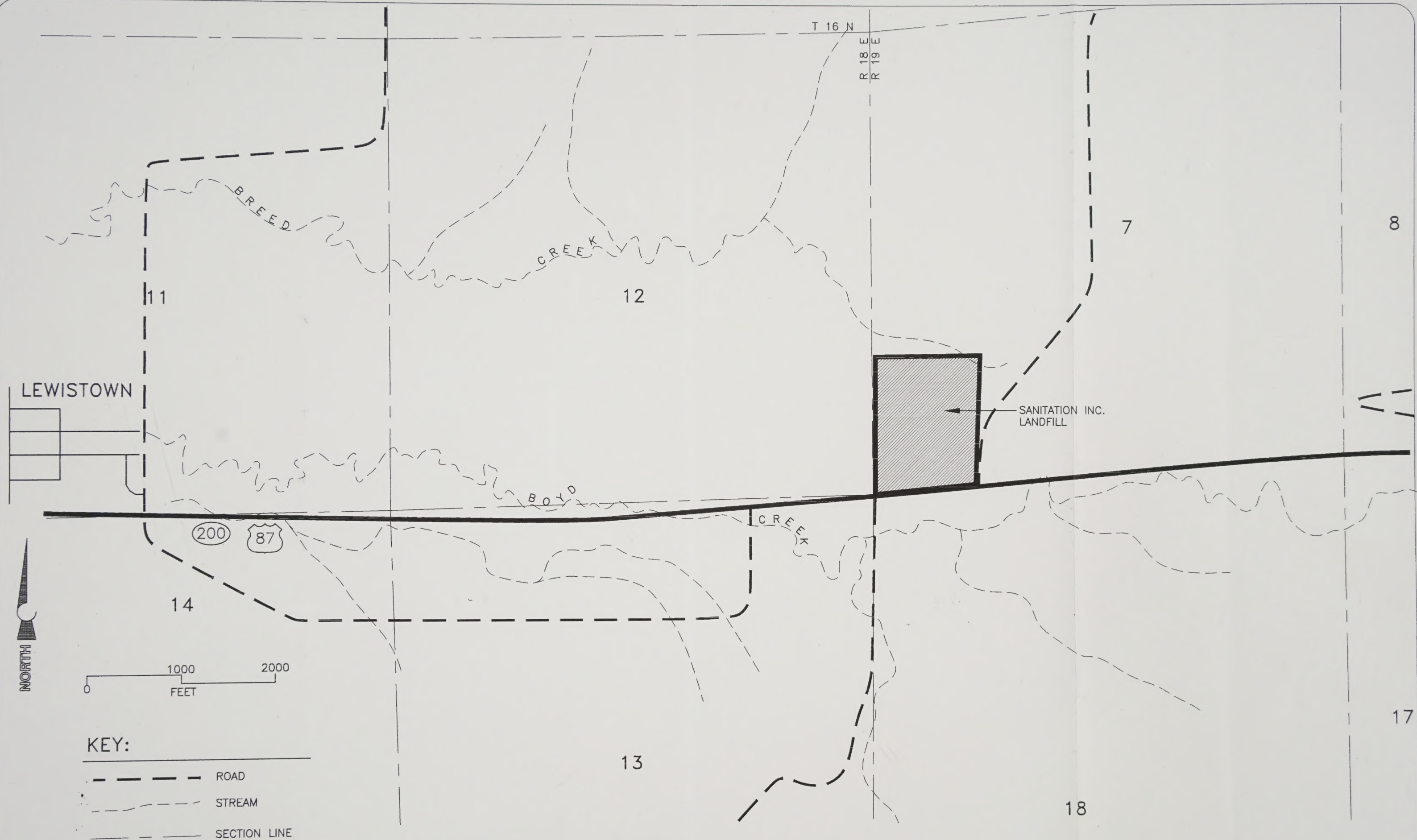


Figure 1. General location of the Sanitation Inc. landfill
Lewistown, Montana

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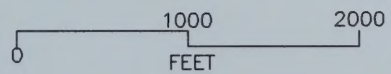
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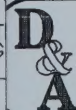
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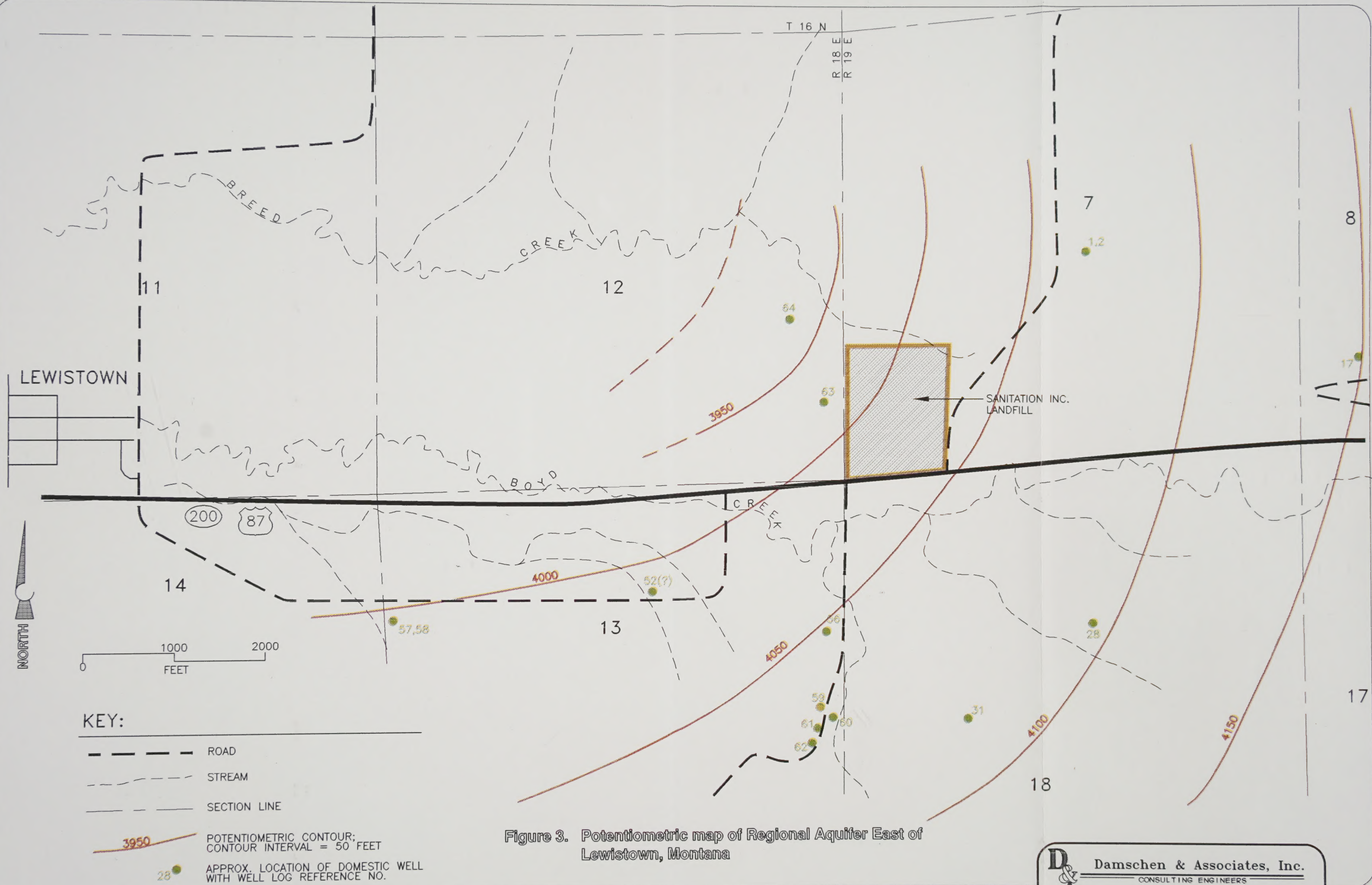
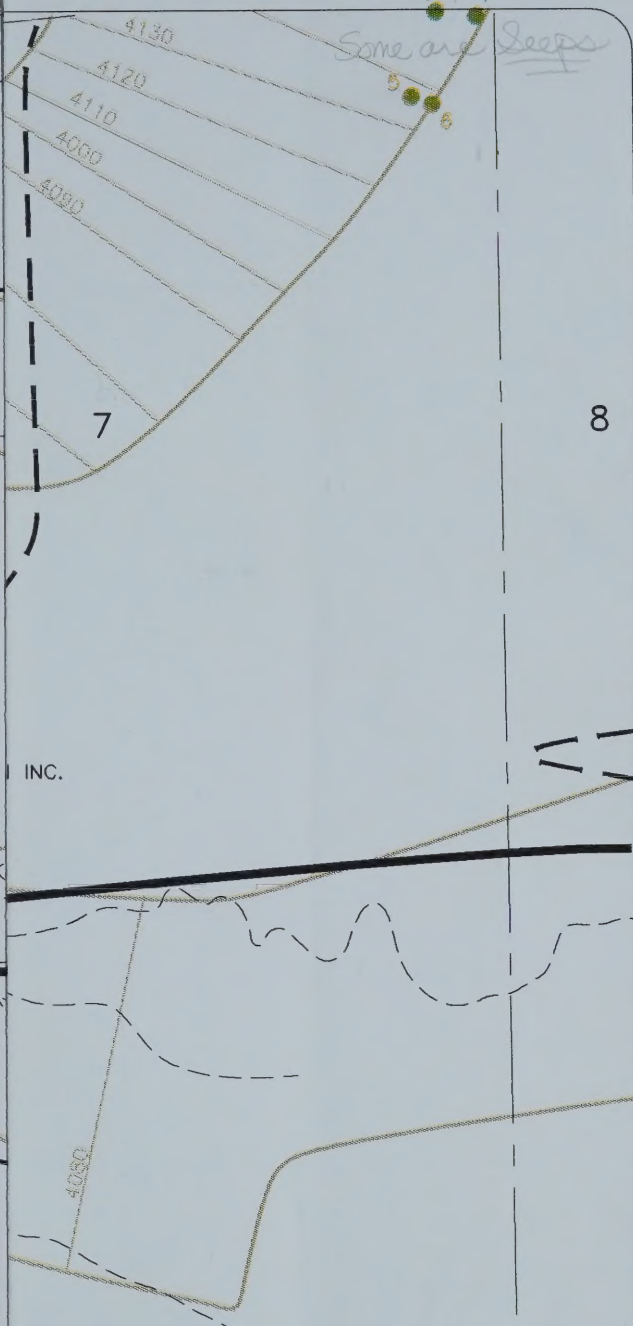


Figure 3. Potentiometric map of Regional Aquifer East of Lewistown, Montana

Some are Deep



LEWISTOWN

INC.

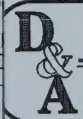
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- - - - - SECTION LINE

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• HELENA, MONTANA •

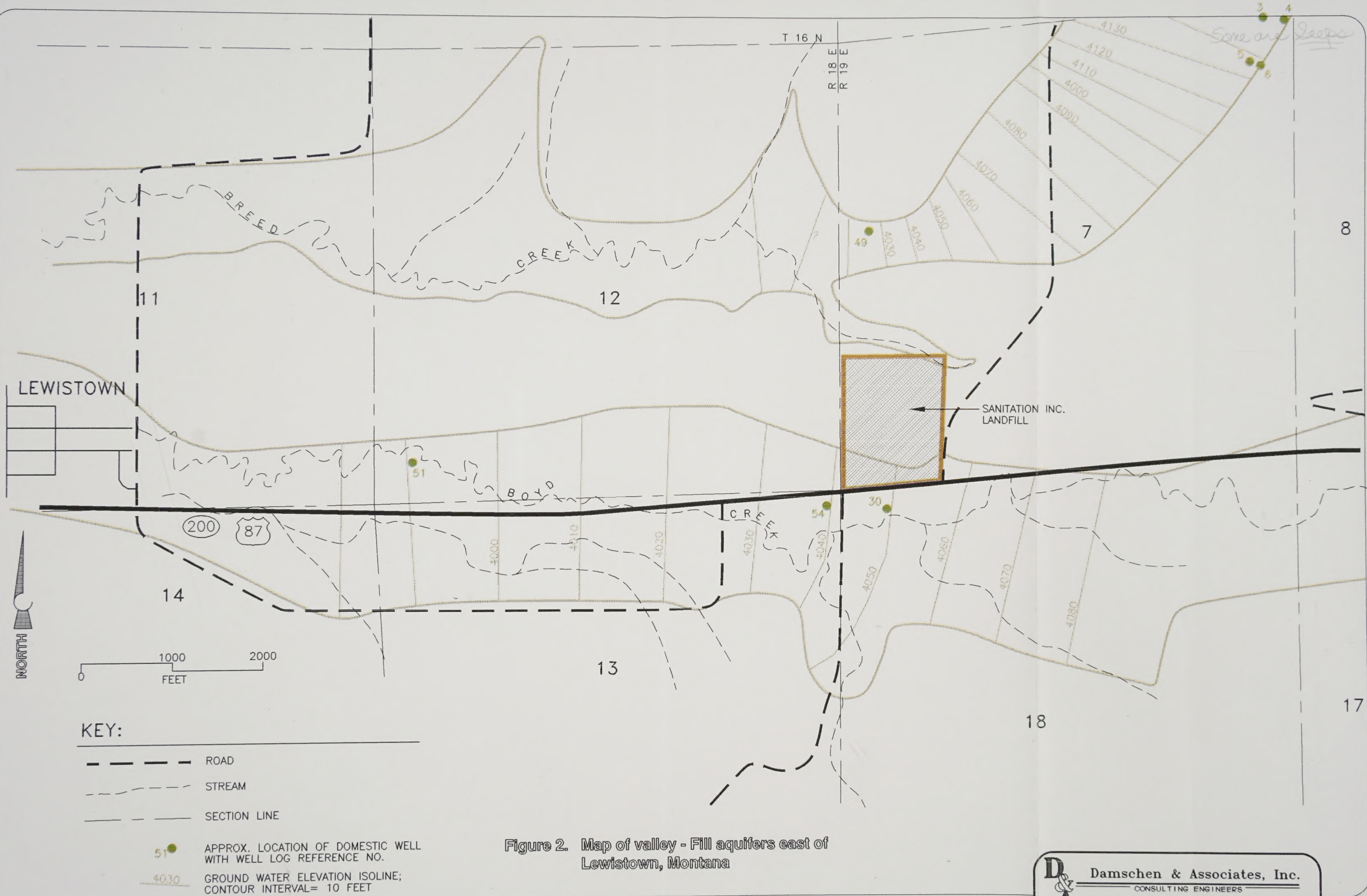
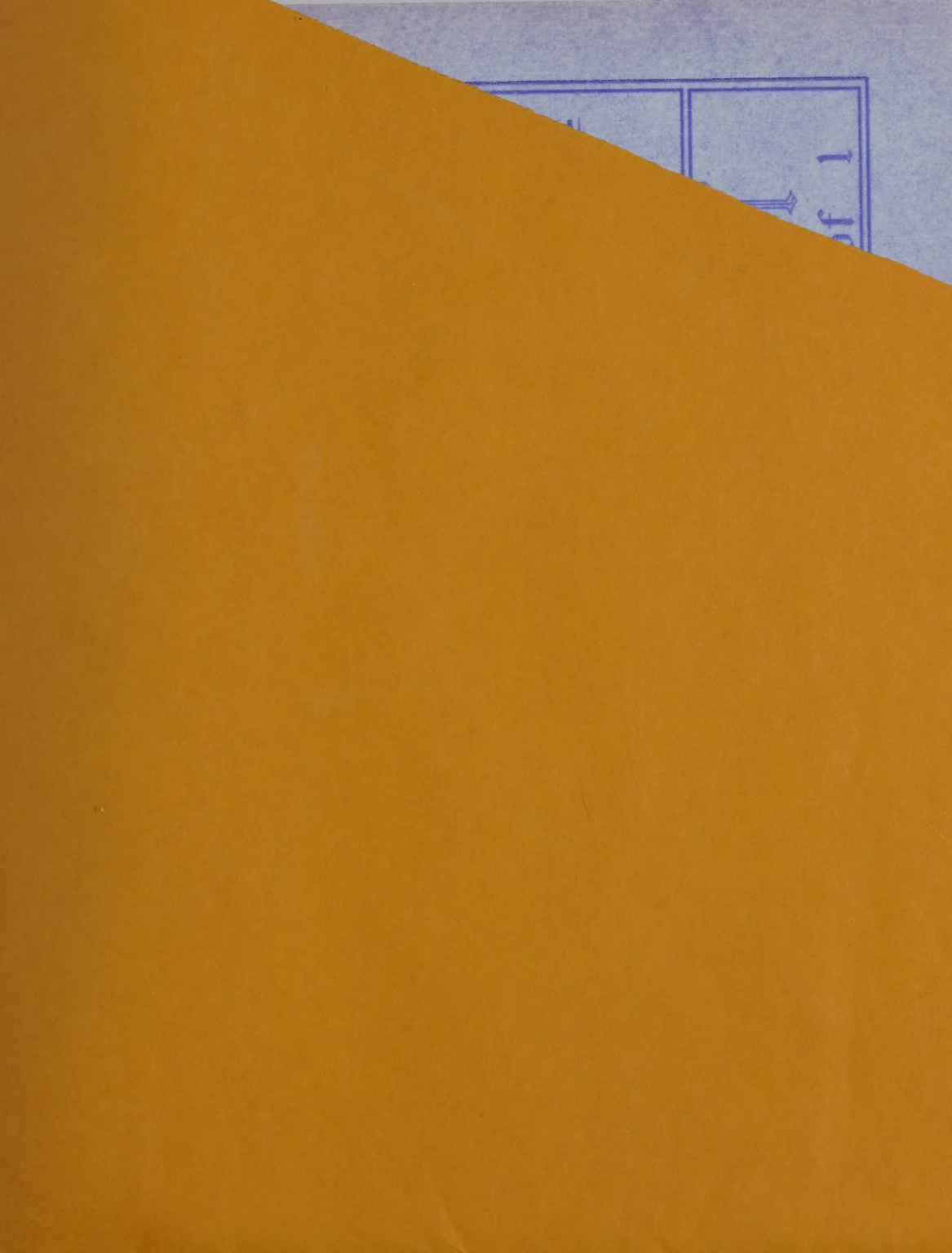
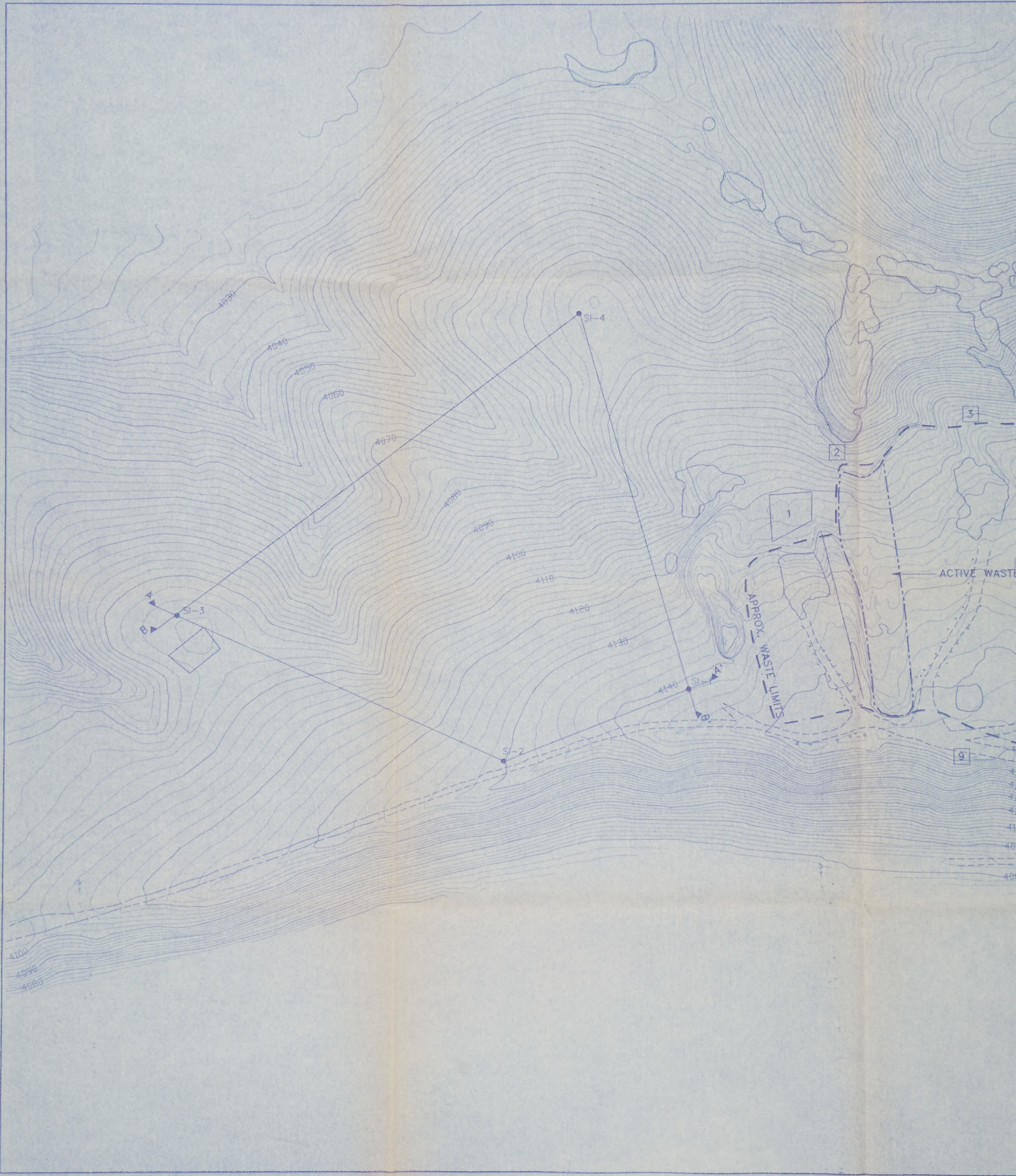


Figure 2. Map of valley - Fill aquifers east of Lewistown, Montana





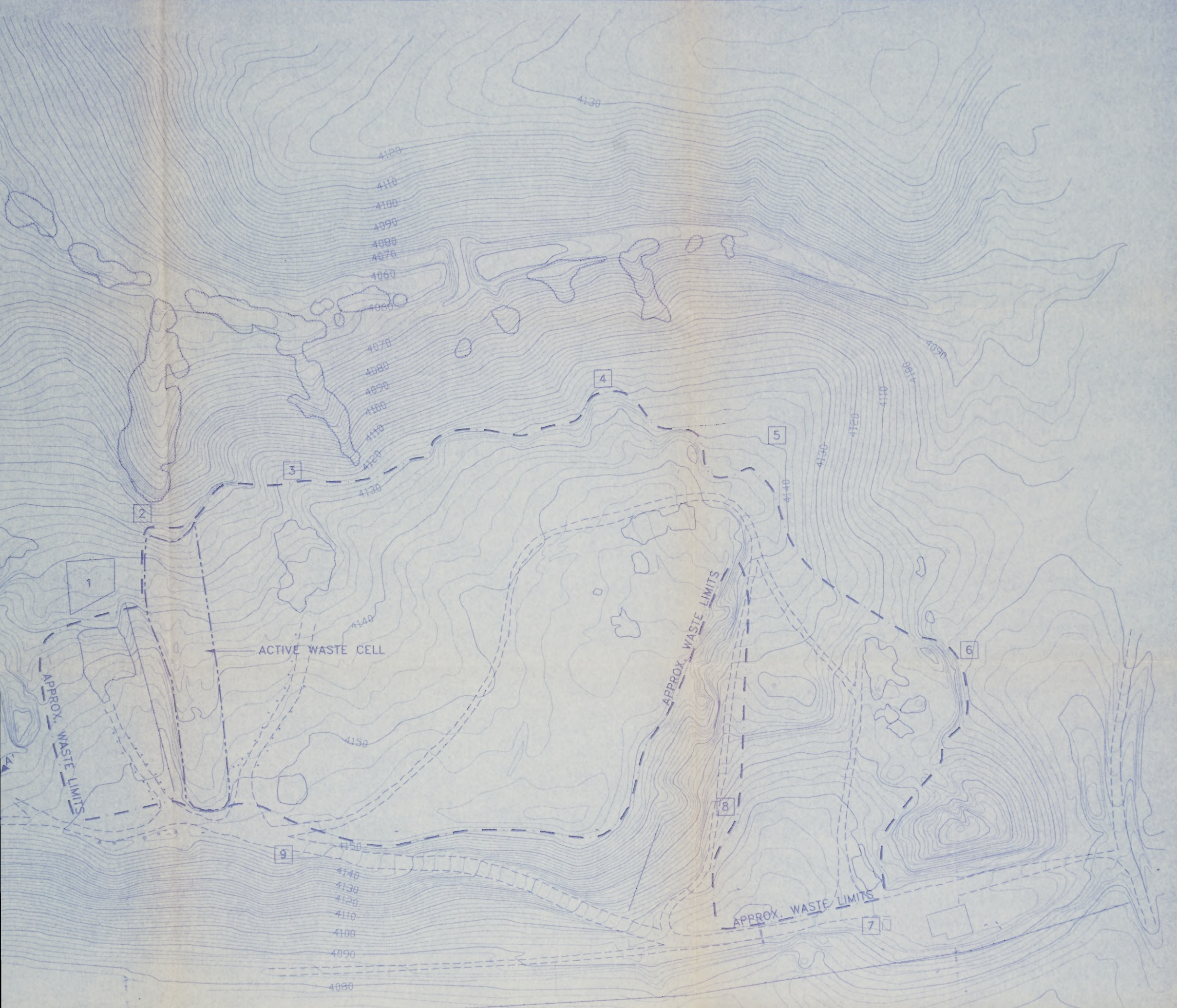


28K-93W
9½ X 12½

Table 1. Table of domestic well logs used for construction of aquifer and potentiometric maps east of Lewistown, Montana.

Reference Number	Estimated Collar Elevation	Estimated Potentiometric Elevation
Deep Aquifer		
1,2	4090	4090
17	4180	4149
13	4300	4190
28	4095	4095
31	4150	4090
52	4045	4015
59-62	4090	4090
56	4055	4055
63*	4122	3935
64*	4095	3995
Valley-fill Aquifer		
3-6	4120-4140	4120-4140
30	4055	4039
51	4000	3988
54	4030	4020

*Damschen & Associates, Inc. test borings; drill logs included in Appendix B.



PROJECT TITLE		
SANITATION INC.		
Lewistown, Montana		
SHEET TITLE		
Plate 1. Proposed locations for Vadose Zone monitoring test borings.		
MONTANA BARRY E. DAMSCHEN 3837E REGISTERED PROFESSIONAL ENGINEER		
D & A Damschen & Associates, Inc. CONSULTING ENGINEERS 2030 11th Ave., Suite 11 HELENA, MONTANA		
JOB/ACAD NUMBER 93-51	△	SHEET NO. 1 of 1
DRAWN BY B.A. NYE	△	
APPROVED BY B. DAMSCHEN	△	
CHECKED BY B. DAMSCHEN	△ 12/94 ADD WELLS	
DATE SEPTEMBER, 1994	△ DATE REVISION	

Table 1. Table of domestic well logs used for construction of aquifer and potentiometric maps east of Lewistown, Montana.

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30	4055	4039
51	4000	3988
54	4030	4020

*Damschen & Associates, Inc. test borings; drill logs included in Appendix B.

Site Investigation

Field Investigation

The preliminary investigation of the site was undertaken on October 5-6, 1993. The study comprised a geological study of surface features and the drilling of three test borings. A single sample of material was obtained from the surface for analysis as a potentially satisfactory liner material. Samples of drill cuttings were obtained on five-foot intervals and representative samples were submitted for mechanical and hydrometric grain-size analysis.

One test boring was drilled prior to Damschen & Associates' involvement at the facility and no log was kept. However, the cuttings from that hole were made available and a drill log has been reconstructed from those samples.

Results

Surface Investigation. Most of the western portion of the property is covered with range grass, so the geology is difficult to interpret without sub-surface support data. However, the eastern portion of the landfill, particularly where roads have been cut and dirt excavated, provides good outcrops. Near the entrance of the landfill is a small hill of fissile black shale overlain in places by lime-encrusted gravel. This material clearly meets the description provided by Calvert (1909) of the Colorado shale, which is of early Cretaceous age. Shale very similar to this occurs within the Kootenai formation, as evidenced in drill cuttings, however, the widespread presence of Colorado Group shale in the area leads to the conclusion that this shale is different from that observed within the Kootenai. While very difficult to determine because of the fissile nature of the rock, the bedding appears to dip to the north at five to ten degrees. Several hundred feet to the west buff to tan cross-bedded sandstone is exposed at the same elevation. It is assumed that the rocks at this outcrop belong to the Cretaceous-aged Kootenai formation. This sandstone also dips generally to the north or northwest, although bedding irregularities makes measurements difficult to obtain. Similar sandstone occurs in the road cut immediately east of the facility entrance.

Sub-surface Investigation. The results of the drilling confirm the geological situation as described by Calvert (1909) and support the apparent northwesterly flow of the deeper of the aquifers in the region. The ground-water flow appears concordant with the northerly dip of the Kootenai formation and the general direction of flow of the main surface drainage, Spring Creek. Water was only detected in two of the test borings, S-2 and S-3. The cuttings returned during the drilling of S-2 were insufficient in volume for extensive sampling or extremely precise lithological descriptions. Cuttings from the other holes, however, added enough data to render the data from S-2 reliable. Cross sections of the ground west of the facility are shown in Figures 4 and 5, and are offered as a qualitative visualization of the

Not on map??

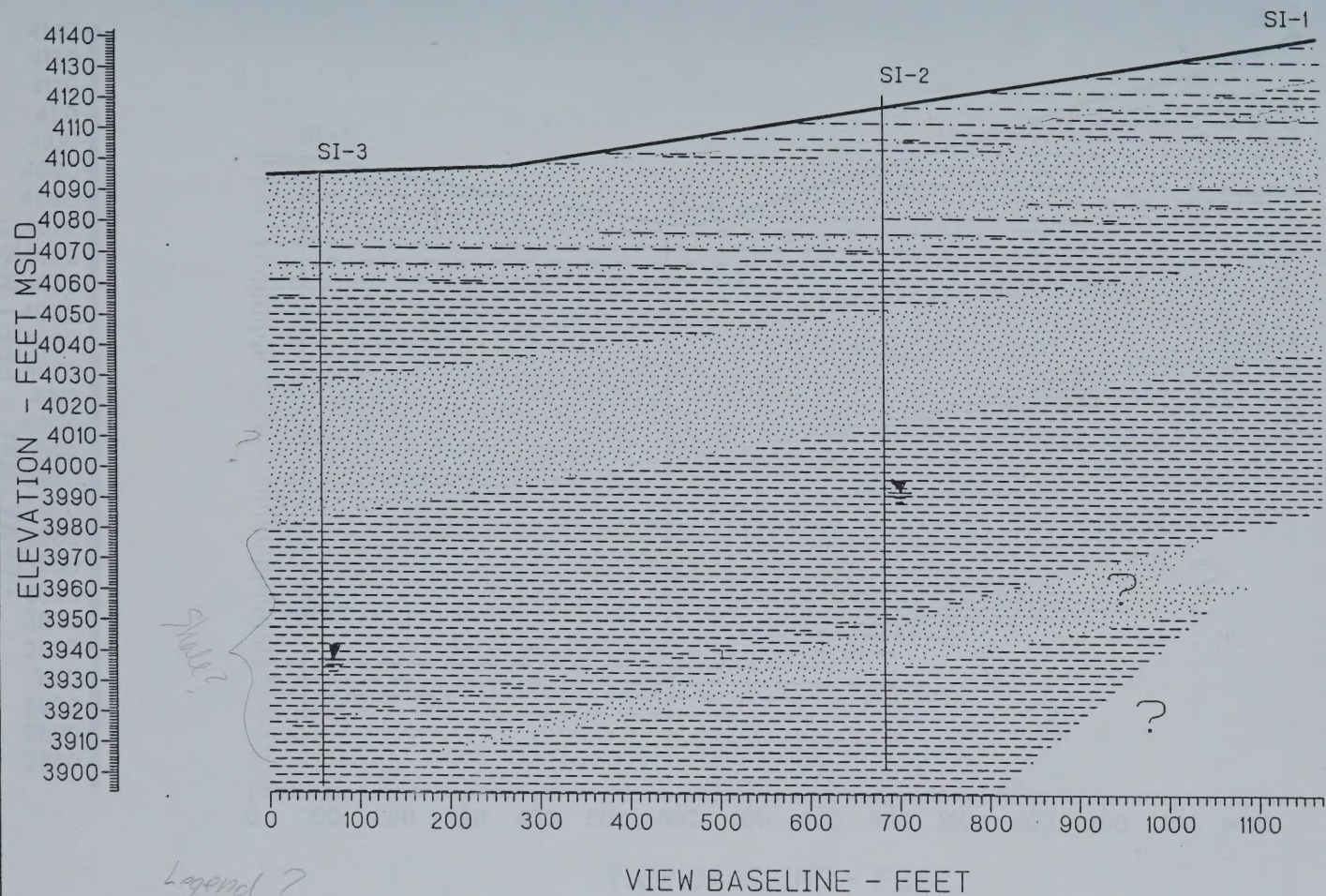


Figure 4. Cross section A-A', Sanitation, Inc. landfill, Lewistown, Montana.

Cross Section View A-A'

Sanitation, Inc., Spoja

93-51

10/6/93

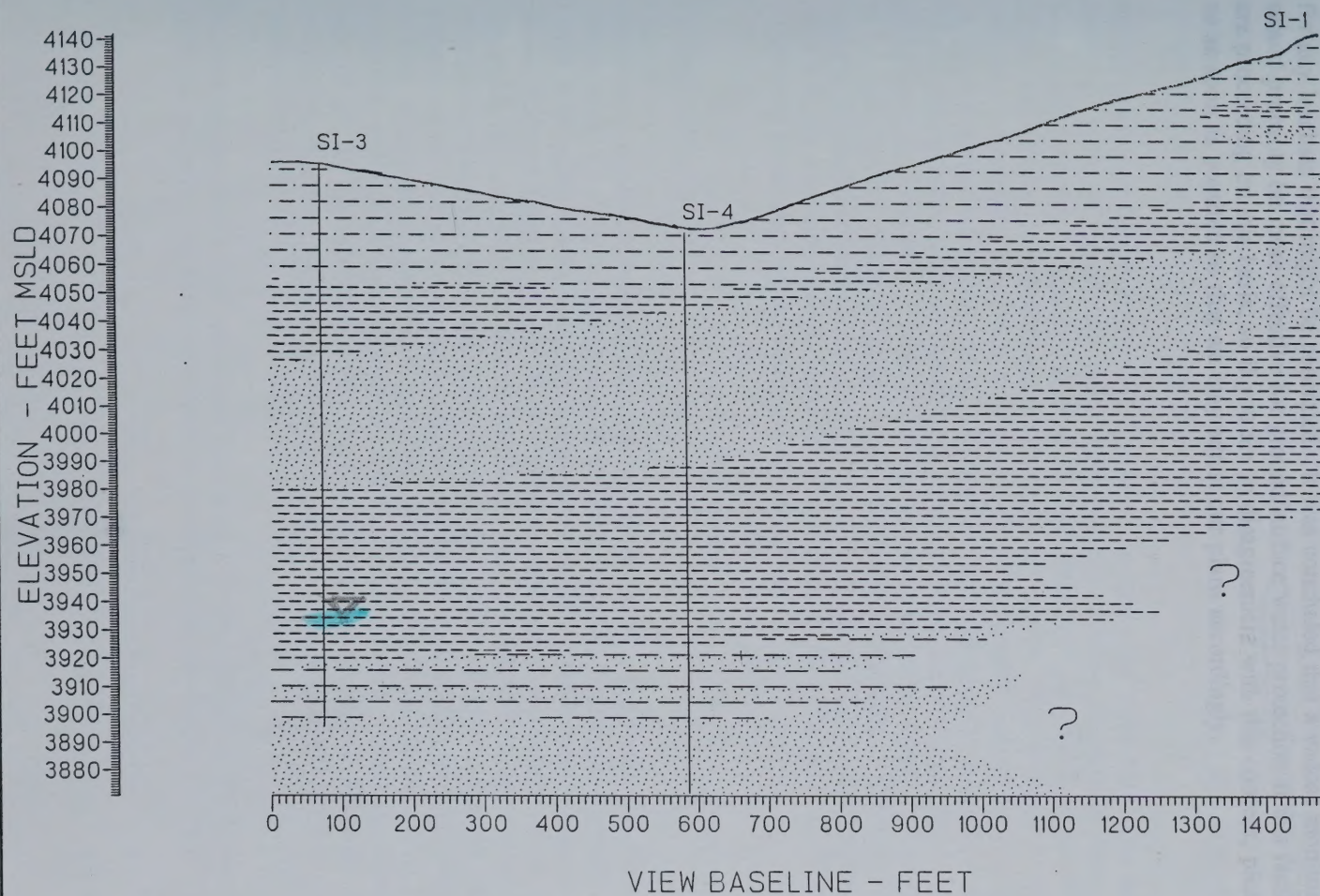


Figure 5. Cross section B-B', Sanitation, Inc. landfill, Lewistown, Montana.

Cross Section View B-B'

Sanitation, Inc., Spoja

93-51

10/6/93

area. Insufficient data are as yet available to characterize the entire facility precisely, and additional cross sections will be submitted upon further exploration of the site.

After prior discussions with Mr. Pat Crowley and Ms. Pat Potts of the Waste Management Division, it was generally agreed that ground-water monitoring is probably inappropriate at this facility due to the excessive depth to the uppermost aquifer. It seems clear that lateral migration to either of the two drainages that flank the facility were more likely destinations for any leachate that might be generated. It was concluded that a vadose monitoring scheme would probably be more effective for ground/surface water protection at this facility. We are proceeding on this basis, so if you are in disagreement with this concept, please contact us as soon as possible so that we may adjust our plans accordingly.

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Not for
sampling
though

As discussed with Mr. Potts and Mr. Crowley, the following Work Plan is an attempt to keep the facility in compliance and, at the same time, develop an effective strategy for the detection of leachate migration pathways in the vadose zone as a means of protecting the uppermost aquifer and region. Efforts are being made by the site. With regard to structure of the proposed procedures, the Waste Management Division has attempted to construct a program of vadose zone monitoring that includes the ground-water protection program as described in AFM 14-10. Specifically, after a year of monitoring, including the vadose zone monitoring, if monitoring is successfully completed, it is proposed that a system of detection monitoring be implemented along some portion of the ground water monitoring. Secondly, a phase of detection monitoring would follow. Should unusual responses in ground water be detected, then an investigation would be initiated to determine if the site is in compliance with the spirit of the law. In spite of an explicit requirement being in place for vadose zone monitoring.

Proposed Procedures

There are a number of ways of detecting changes in moisture content of soils. In conducting the current for monitoring of the leachate, the facility. It is proposed that the object is to install a detection monitoring system similar to a ground-water monitoring system for detection purposes. With this objective in mind, the number of detection points somewhat more limited, and several methods of detection were considered. For example, drilling a core sample and measuring the moisture from given depth intervals is without a doubt the most accurate, precise and reliable method for the detection of moisture content and potential contaminant detection available. However, the procedure is extremely expensive and non-conservative, and is an inherently destructive method that does not allow repeatability of measurements. This might be an appropriate process of extensive and intensive is detected and concentrations is suspected, but is simply not suitable for a detection monitoring system.

Soil moisture sensors are also available to be very effective for the detection of moisture for chemical analysis, and were considered for installation at this facility. However, these are

Proposed Vadose Zone Monitoring Plan

Introduction

In order to characterize the movement of soil moisture at any facility two items are necessary: properly located testing probes and time. On behalf of the owner and operators of Sanitation, Inc., Damschen & Associates requests that the Department consider the installation and operation of a vadose zone monitoring plan to characterize the presence and migration of soil moisture at the landfill. The procedures are discussed below, and the results of the testing, which will take at least a year, will be submitted to the Department in January, 1996. If testing has provided the appropriate data, then a No-migration Demonstration shall also be submitted at that time. -No!

As discussed with Ms. Potts and Mr. Crowley, the following Work Plan is an attempt to keep the facility in compliance and, at the same time, develop an effective strategy for the detection of leachate migration pathways in the vadose zone as a means of protecting the uppermost aquifer and aquifer^(s) laterally proximal to the site. With regard to structure of the proposed procedures, Damschen & Associates has attempted to construct a program of vadose zone monitoring that mimics the ground-water protection program outlined in ARM 14.16. Specifically, after a year of monitoring, assuming that a No-migration Demonstration is successfully completed, it is proposed that a system of detection monitoring be emplaced along lines similar to that for ground water-monitoring. Similarly, a phase of assessment monitoring would follow, should unusual moisture migration activity be detected. Damschen & Associates feel that this is in keeping with the spirit of the rules, in spite of no specific regulations being in place for vadose zone monitoring. ?

Proposed Procedures

There are a number of ways of determining changes in moisture content of soils. In examining the options for proceeding at the Sanitation, Inc. facility, it is presumed that the object is to install a detection monitoring system similar to a ground-water monitoring contaminant detection program. With this objective in mind, the number of choices became somewhat more limited, and several methodologies were immediately dismissed. For example, drilling a core sample and extracting the moisture from given depth intervals is without a doubt the most accurate, precise and reliable method for the detection of moisture content and potential contaminant detection available. However, the procedure is extremely expensive and time-consuming, and is an inherently destructive method that does not allow repeatability of measurements. This might be an appropriate process if excessive soil moisture is detected and contamination is suspected, but is simply not suitable for a detection monitoring system.

Suction lysimeters are also considered to be very effective for the collection of moisture for chemical analysis, and were considered for installation at this facility. However, these are

very expensive, and installation requires skills and equipment that are simply not available in the state of Montana. In addition, suction lysimeters are best for sampling a discrete stratum for contaminants introduced via gaseous or volatile contaminants. Until such a situation can be identified, the use of these instruments is simply not appropriate for detection monitoring.

It is also possible that simple dry wells could be installed to the depth of the first stratum of finer-grained material detected below the base of the fill areas, with the intention of having excess fluids seep into the wells. While this is a straightforward and apparently practical solution, it is not at all certain that it would be effective with regard to the protection of ground- and surface-water resources proximal to the site. The problem lies with being able to precisely match the grain size, porosity and soil suction characteristics of the screened intervals with that of the surrounding unsaturated soils. If the soil suction is higher in the surrounding soil, or if a formation with a higher soil suction underlies the well, then fluids will simply bypass the installation. In addition, if the screened interval depths are not carefully installed, there is an opportunity for fluids to flow down the side of the borehole into a different stratum, thus allowing for potential cross-contamination of strata without detection.

After examining these and other potential methods of detection for excessive moisture in the vadose zone, it was determined that the most efficient and cost-effective procedure involves the installation of vertical dry wells that are tested semi-annually with a down-hole neutron-emitting probe. In the event that a neutron device is not available at a reasonable cost, a gamma-emission probe will be used. The gamma units are probably as useful as the neutron probes, but no literature is available regarding the use of these for this particular application. Down-hole moisture detection systems, including neutron probe systems, are generally a requisite in some states, such as California, where new landfills are commonly required to install horizontal wells beneath landfills in order to run geophysical probes under the liner.

The neutron probe installations require the placement of steel well casing in fairly large-diameter borings that are strategically placed in locations and at depths likely to discern moisture changes in the sub-surface. The casing will be installed using an under-reaming system or by driving the casing into an undersized hole in order to prevent the migration of moisture along the sides of the casing, thus preventing the erroneous appearance of migrating fluids. This also prevents the movement of fluids from one zone to another, should saturated migration occur at any point in time. Samples of the soil are collected during drilling and subsequently analyzed for moisture content, with the resultant data used to calibrate the output from the neutron emission probe. The collection of samples at depth for moisture content analysis can be somewhat of a problem, particularly if an air rotary rig is employed for drilling. Warm air circulating throughout the hole can evaporate the moisture in cuttings. In the case of the Sanitation, Inc. facility, however, the neutron probe wells will most likely be on the order of 20 to 30 feet in total depth, making the problem of drying the samples considerably less critical, and any loss of moisture will be small and evenly distributed; all of the samples will lose approximately the same amount of moisture. Nonetheless, care will be taken to obtain representative samples because of the importance of determining the

existing soil moisture levels. If possible, split-spoon or core samples will be taken during drilling at regular intervals in order to correlate any moisture loss due to air return. Alternatively, split-spoon or core samples will be retrieved in other test borings proximal to the neutron probe wells at similar depth intervals, although this is a less-desirable option.

The detection monitoring will then proceed on a regular basis, with quarterly testing initially recommended for the Sanitation, Inc. facility. The frequency of testing will be re-evaluated after the first two events and reviewed with the Department. The testing events entail dropping the probe down each well to prescribed depths for a short period of time to gather a reading, then comparing the results with the established standards and previously-collected semi-annual data. As with ground-water chemistry, some variation in soil moisture trends will occur as a result of seasonal changes or large-magnitude weather events. This can be problematic at facilities where waste is in place, where no true background data can be collected. Conversely, interpretive problems can also arise at new facilities where the ground water and vadose zones are profoundly affected by the disturbances of cell excavation and liner installation. Therefore, a period of time for baseline data collection is required, and an initial period of more intensive testing is appropriate. The baseline period needs to encompass a period sufficiently long to allow for testing during the full natural range, without testing during times at which anomalous circumstances exist. For example, an initial testing period might be assigned as quarterly, which would seem to be appropriate in terms of testing temporal variation. However, sampling during periods when soil temperature and air temperature disparities exceed dew point might result in "sweating" on the casing, resulting in aberrant moisture readings. It is recommended, therefore, that some leeway in testing schedules be accommodated in order to ensure quality data collection.

It is also recommended that at least one well be installed away from the fill areas but within similar strata as the detection wells. This provides for a control that may help in establishing natural variations in soil moisture both spatially and temporally.

All of the methods examined for a vadose zone monitoring program at this facility had deficiencies of some variety or magnitude. Despite the potential problems of employing a down-hole moisture-detection system, this method far surpasses any other in many regards. The system is simple to install, easy to calibrate using on-site soil moisture, and has been shown to be reliable for the detection of soil moisture changes.

Proposed Field Work

In order to establish the appropriate locations for moisture-probe wells, a relatively extensive drilling program will have to be undertaken, preferably in conjunction with the installation of methane monitoring probes. The object of the drilling program would be to establish the depth to the first stratum beneath the fill area at which a significant grain-size change occurs. The determination of a fluid migration barrier or pathway is essential in the establishment of both vadose zone and methane monitoring systems.

At the moment, the site is being modeled on available data, which indicate that the fill areas are located within silty sand or argillaceous sandstone that is underlain by clay shale strata of variable thickness. Near the fill area, the clay strata appear to be on the order of a few feet in thickness in the upper 30 feet. This is sufficiently thick to act as a barrier to downward migration of fluids by several mechanisms. The uppermost clay stratum beneath the fill area will have a different soil suction potential (presumably much higher) than the overlying sandstone. Depending upon the saturation, porosity, and other characteristics of each lithologic unit, moisture will either move laterally atop the finer-grained stratum or within the finer-grained stratum. In either case, the potential for fluid migration through a clay bed vertically to an underlying unit is remote, making the contact between the strata an important monitoring target for both gas and liquids.

- horizontal extent?

← ?

} assuming clays are contiguous

Because the eastern portion of the landfill has not been characterized to our satisfaction in light of the recently-established sub-surface monitoring parameters, we propose that a number of holes be drilled across the entire site so that correlations may be clearly established. Some logistical problems may arise that preclude the drilling being undertaken in a single trip, such as building drill pads toward the northern portions of the facility, but every effort will be made to complete the sub-surface investigation in a single outing.

The proposed test boring locations are denoted on the enclosed facility site plan. Please note that the potential locations of down-hole moisture probe wells are not shown. This is because the precise locations cannot be established until additional sub-surface details can be delineated. In a general sense, at least one well will be completed down-dip from each fill area. At least one "background" well, and possibly two wells, will be installed proximal to but on strike or up-dip from the fill areas, as established by the stratigraphy.

With regard to procedure, Damschen & Associates will continue to employ drilling contractors that meet the necessary regulatory constraints. We will also ensure that the appropriate field protocol is established and adhered to by all field personnel. Sampling and analysis procedures will follow those outlined in ARM 16.14.706, which deal with the field procedures and data-collection requirements for a Hydrogeological and Soils Study.

Discussion and Summary

It seems that there is little disagreement between parties that ground-water monitoring at the Sanitation, Inc. landfill is not a procedure that would truly be the most protective of Montana's ground water. This having been established, the problem becomes one of ensuring that the detection monitoring system established at the site is effective with regard to the detection of fluid migration and, at the same time, proves reasonable in terms of owner/operator cost. Damschen & Associates feels that the use of a down-hole geophysical probe, in particular a neutron-emitting device, has been shown to meet both of those criteria.

There are aspects to this program that present challenges to both the Department and Damschen & Associates. We ask your patience with the establishment of the system, because of its relative **novelty**. At the same time, we realize that the Department has not yet had the opportunity to work with a vadose monitoring system, and so we will attempt to provide as much documentation as possible with regard to the installation, testing, and maintenance of such networks.

In summary, Damschen and Associates, with the approval of the Department, will undertake a program of sub-surface investigation at the Sanitation, Inc. landfill in Lewistown, Montana. The object of the study is to establish sub-surface locations and extent of strata that would act as barriers to fluid flow. The delineation of such strata will allow field personnel to establish appropriate locations for both vadose-zone monitoring wells and methane monitoring wells. The program of vadose-zone monitoring will include the determination of **soil moisture from down-hole soil samples**, which, in turn, will allow for the establishment of a **baseline of data**. It is recommended that a subsequent program of monitoring encompass four testing events during 1995 followed by a semi-annual testing regime. This will allow for the establishment of spatial and temporal variations in soil moisture and a clear source delineation of any fluid migration that might be detected.

We are looking forward to establishing what amounts to the first vadose monitoring system in the state of Montana. As noted above, we will provide as much literature information as we can and, we ask for your patience with this project. We would like to involve the Department with all phases of this work, if that is agreeable, beginning with a meeting at your earliest convenience to review the documents being submitted in conjunction with this Work Plan. These documents include the **No-migration Demonstration** and the Methane Monitoring Plan. In the meanwhile, if you have any questions or require any additional information, please do not hesitate to contact us.

References

Calvert, W. R., 1909, Geology of the Lewistown coal field, Montana: U.S. Geological Survey Bulletin 390, U.S. Government Printing Office, Washington, D.C.

LOCATION.....	REFERENCE NUMBER	SITE NAME.....	TOTAL DEPTH FEET....	STATIC WATER LEVEL (FT)	YIELD GPM.....	WATER YEAR USE.....	LITHOLOGY PRESENT..	PERF FROM (FT)....	PERF TO (FT)....
15N 19E 06 BC	1	WILKINS LEORA	728.0			1980 UNKNOWN		485.0	655.0
15N 19E 06 CDD	2	WILKINS JAMES C.	14.0		4.0	1900 STOCKWATER DOMESTIC			
15N 19E 06 CDD	3	WILKINS JAMES C.	14.0		4.0	1900 STOCKWATER DOMESTIC			
15N 19E 07 AA	4	WILKINS JAMES C.		10.00		1900 DOMESTIC STOCKWATER			
15N 19E 07 BD	5	WILKINS LEORA	720.0		2.0	1980 UNKNOWN		600.0	720.0
15N 19E 07 BD	6	WILKINS LEORA	490.0	0.00	12.0	1982 STOCKWATER		270.0	310.0
15N 19E 07 CD	7	SANDE STEVE	187.0		10.0	1989 DOMESTIC STOCKWATER		150.0	187.0
15N 19E 08 A	8	COX RICHARD	220.0	100.00	50.0	1982 UNKNOWN		200.0	220.0
15N 19E 08 AB	9	BATSCOM GARTH	220.0	140.00	20.0	1980 DOMESTIC		180.0	220.0
15N 19E 08 AC	10	DENTON RONALD	244.0	146.00	20.0	1981 UNKNOWN		144.0	244.0
15N 19E 08 ACCA	11	JOHNSON CLARK	140.0	73.00	12.0	1978 DOMESTIC		40.0	140.0
15N 19E 08 BA	12	RINDAL RALPH	220.0	40.00	15.0	1983 UNKNOWN		180.0	220.0
15N 19E 08 BDD	13	JOHNSON CLARK	280.0	110.00	50.0	1981 UNKNOWN		260.0	280.0
15N 19E 08 CBC	14	LARSON JIM	350.0	70.00	15.0	1978 DOMESTIC		250.0	350.0
15N 19E 08 CC	15	SWEENEY TRACE	297.0	60.00	12.0	1984 DOMESTIC		72.0	92.0
15N 19E 08 CC	16	ZIESMAN R. G.	212.0		24.0	1982 UNKNOWN			
15N 19E 08 CCBA	0117	LARSON ART * 4 MI EAST LEWISTOWN MT	320.0	31.15	13.7	1978 DOMESTIC	YES	220.0	320.0
15N 19E 08 CCC	0118	DUFFY DAVID	220.0		4.5	1978 DOMESTIC	YES	160.0	220.0
15N 19E 08 CD	18	IRELAND IAN	127.0			1982 DOMESTIC STOCKWATER		87.0	127.0
15N 19E 08 CD	20	WALCOTT LEON	160.0		4.0	1978 DOMESTIC		60.0	160.0
15N 19E 08 CD	0121	KALAL DICK	180.0		100.0	1983 DOMESTIC	YES	140.0	180.0
15N 19E 08 DA	22	JACKSON ROBERT	260.0	100.00	20.0	1981 UNKNOWN		220.0	260.0
15N 19E 08 DBC	0123	TUCK HENRY	280.0	113.00	20.0	1994 DOMESTIC	YES	230.0	260.0
15N 19E 08 DC	24	BURLIEGH GAIL	135.0	35.00	100.0	1970 DOMESTIC		100.0	135.0
15N 19E 08 DCCA	0125	MARVIN MINTYALA * 4 MI E LEWISTOWN	120.0	52.66	7.1	1976 DOMESTIC	YES	80.0	120.0
15N 19E 08 DDD	26	JACKSON DORMAN	190.0	6.00	35.0	1963 STOCKWATER			
15N 19E 17 BABD	0127	CANTRELL DANIEL * 5 MI EAST LEWISTOWN MT	558.0		36.0	STOCKWATER	YES	90.0	250.0
15N 19E 18 ACB	28	KARINEN CHARLIE	262.0	0.00	23.0	1986 DOMESTIC		202.0	262.0
15N 19E 18 BB	29	HENDERSON PAT	40.0	10.00	15.0	1978 DOMESTIC		20.0	40.0
15N 19E 18 BBB	0130	HENDERSON PAT	54.0	16.00	20.0	1993 DOMESTIC	YES	35.0	54.0
15N 19E 18 CA	31	CUMMINGS CHET & F	280.0	60.00	40.0	1985 DOMESTIC		220.0	280.0
15N 19E 18 CBBD	0132	EATINGER RUTH * 3 MI SE LEWISTOWN MT	120.0	-17.30	1.5	1976 DOMESTIC	YES	95.0	120.0

2 records listed.

LOCATION.....	REFERENCE NUMBER	SITE NAME.....	TOTAL DEPTH FEET.....	STATIC WATER LEVEL (FT)	YIELD GPM.....	WATER YEAR USE.....	LITHOLOGY PRESENT..	PERF FROM (FT)....	PERF TO (FT)....
15N 18E 01 ABC	0133	MCDONALD BILL	660.0		15.0	1987 STOCKWATER	YES	600.0	640.0
15N 18E 11	34	BROWN WILLIE B	96.0		0.0	1951 DOMESTIC			
15N 18E 11	35	HANSEN FRED C	380.0			1948 IRRIGATION			
15N 18E 11	36	LEWISTOWN BRICK YARD	570.0			1954 UNKNOWN			
15N 18E 11 AACC	0137	WILKINS JAMES JR *	490.0	6.81	4.1	1978 STOCKWATER	YES	430.0	490.0
		0.75 MI NE LEWISTOWN							
15N 18E 11 CA	0138	MOBERLEY AROD	155.0	0.00	12.0	1990 DOMESTIC	YES	95.0	155.0
15N 18E 11 CAC	37	BAUMAN ELDRED	155.0	125.00	10.0	1959 INDUSTRIAL			
15N 18E 11 CD	40	HOSTETTER CARL	25.0	15.00	10.0	1940 DOMESTIC			
						IRRIGATION			
15N 18E 11 CDB	41	BISHOP DARRELL L.	14.0		10.0	1930 DOMESTIC			
15N 18E 11 DC	42	MCDONALD BILL	70.0	3.00	80.0	1957 INDUSTRIAL		5.0	70.0
15N 18E 11 DCB	43	MCDONALD BILL	100.0	40.00	30.0	1962 INDUSTRIAL			
15N 18E 11 DCB	44	MCDONALD J.C.	75.0	3.00	250.0	1957 INDUSTRIAL			
15N 18E 11 DCB	45	MCDONALD J.C.	140.0	20.00	30.0	1960 DOMESTIC			
15N 18E 11 DCC	46	CROWLEY GERTRUDE R.	12.0	8.00		1919 DOMESTIC			
15N 18E 11 DCC	47	NAYLOR JIM	85.0	20.00	25.0	1977 DOMESTIC		60.0	85.0
15N 18E 11 DCCC	48	KOLIHA EMMA	12.0		5.0	1923 DOMESTIC			
						IRRIGATION			
15N 18E 12 ADD	49	SPOJA WILLIAM	25.0	12.00	5.0	1900 STOCKWATER			
						DOMESTIC			
15N 18E 12 BBA	50	MCDONALD J.C.	1100.0		80.0	1948 DOMESTIC			
						STOCKWATER			
15N 18E 12 CCC	51	SPOJA WILLIAM	22.0	12.00	10.0	1938 DOMESTIC			
						STOCKWATER			
15N 18E 13 A	52	CRIMINS MIKE	100.0	30.00	50.0	1984 DOMESTIC		70.0	90.0
15N 18E 13 AA	53	SKIBBY EDWARD	65.0		20.0	1943 STOCKWATER			
						DOMESTIC			
15N 18E 13 AAA	54	SKIBBY EDWARD	36.0	10.00	50.0	1964 OTHER			
15N 18E 13 AACC	55	LEWIS BERNARD	50.0		5.0	1930 STOCKWATER			
						DOMESTIC			
15N 18E 13 ADDB	56	LEWIS BERNARD	145.0		5.0	1945 STOCKWATER			
15N 18E 13 BCB	57	LECOUNT RAY	90.0	20.00	10.0	1893 STOCKWATER			
						DOMESTIC			
15N 18E 13 BCB	58	LECOUNT RAY	90.0	60.00	10.0	1949 STOCKWATER			
						DOMESTIC			
15N 18E 13 DAA	59	LEWIS BERNARD	150.0		35.0	1945 STOCKWATER			
15N 18E 13 DAAA	60	LEWIS BERNARD	24.0			1900 DOMESTIC			
15N 18E 13 DAAB	61	LEWIS BERNARD	24.0			1900 DOMESTIC			
15N 18E 13 DAAC	62	LEWIS BERNARD	150.0		5.0	1915 STOCKWATER			

0 records listed.

①
Deepened

1. WELL OWNER Name <u>Leora Wilkins</u> 2. CURRENT MAILING ADDRESS <u>106 E. Lake</u> <u>Lewistown, MT 59457</u> 3. WELL LOCATION SE 1/4 NW 1/4 1/4 Section <u>7</u> Township <u>15</u> N 10 Range <u>19</u> E/W County <u>Fergus</u> Lot _____ Block _____ Subdivision _____ Well Elevation _____ Accuracy: _____ ± 10'; _____ ± 50'; _____ ± 100';	6. WATER LEVEL Static water level _____ feet below land surface If flowing, closed-in pressure _____ psi <u>2</u> gpm flow through <u>1</u> inch pipe Controlled by: ☒ valve, _____ reducers, _____ other (if other, specify) _____ 7. WELL TEST DATA _____ pump _____ bailer _____ other (if other, specify) _____ Pumping level below land surface: ft. after _____ hrs. pumping _____ gpm ft. after _____ hrs. pumping _____ gpm 8. WAS WELL PLUGGED OR ABANDONED? ☒ Yes ☐ No If yes, how? _____ 9. DATE STARTED <u>16 Sept, 1980</u> <u>Nov. 14, 1980</u> DATE COMPLETED <u>8 Oct, 1980</u> <u>Dec 1, 1980</u> 10. WELL LOG <table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th>Depth (ft.)</th> <th>From</th> <th>To</th> <th>Formation</th> </tr> </thead> <tbody> <tr><td>0</td><td>0</td><td>8</td><td>Surface drift</td></tr> <tr><td>8</td><td>8</td><td>36</td><td>Gravel</td></tr> <tr><td>36</td><td>36</td><td>42</td><td>Sandstone</td></tr> <tr><td>42</td><td>42</td><td>43</td><td>Rock</td></tr> <tr><td>43</td><td>43</td><td>77</td><td>sandstone w/ shale</td></tr> <tr><td>77</td><td>77</td><td>172</td><td>Redbeds</td></tr> <tr><td>172</td><td>172</td><td>187</td><td>sandstone</td></tr> <tr><td>187</td><td>187</td><td>224</td><td>Redbeds</td></tr> <tr><td>224</td><td>224</td><td>240</td><td>White sandstone</td></tr> <tr><td>240</td><td>240</td><td>265</td><td>White sandstone water</td></tr> <tr><td>265</td><td>265</td><td>272</td><td>Redbeds</td></tr> <tr><td>272</td><td>272</td><td>308</td><td>Gray sand</td></tr> <tr><td>308</td><td>308</td><td>346</td><td>Redbeds</td></tr> <tr><td>346</td><td>346</td><td>360</td><td>Gray sand</td></tr> <tr><td>360</td><td>360</td><td>432</td><td>Redbeds</td></tr> <tr><td>432</td><td>432</td><td>434</td><td>Hard rock</td></tr> <tr><td>434</td><td>434</td><td>510</td><td>White sand</td></tr> <tr><td>510</td><td>510</td><td>512</td><td>Coal</td></tr> <tr><td>512</td><td>512</td><td>538</td><td>Dark sand</td></tr> <tr><td>538</td><td>538</td><td>540</td><td>Coal</td></tr> <tr><td>540</td><td>540</td><td>612</td><td>Dark sand w/ coal</td></tr> <tr><td>612</td><td>612</td><td>680</td><td>Well Deepened on Nov 14 - Dec 1, 1980</td></tr> <tr><td>680</td><td>680</td><td>710</td><td>Gray sand & shale w/ coal hard</td></tr> <tr><td>710</td><td>710</td><td>720</td><td>Brown sandstone</td></tr> <tr><td>720</td><td>720</td><td></td><td>Shale w/ lime rock layers</td></tr> </tbody> </table>	Depth (ft.)	From	To	Formation	0	0	8	Surface drift	8	8	36	Gravel	36	36	42	Sandstone	42	42	43	Rock	43	43	77	sandstone w/ shale	77	77	172	Redbeds	172	172	187	sandstone	187	187	224	Redbeds	224	224	240	White sandstone	240	240	265	White sandstone water	265	265	272	Redbeds	272	272	308	Gray sand	308	308	346	Redbeds	346	346	360	Gray sand	360	360	432	Redbeds	432	432	434	Hard rock	434	434	510	White sand	510	510	512	Coal	512	512	538	Dark sand	538	538	540	Coal	540	540	612	Dark sand w/ coal	612	612	680	Well Deepened on Nov 14 - Dec 1, 1980	680	680	710	Gray sand & shale w/ coal hard	710	710	720	Brown sandstone	720	720		Shale w/ lime rock layers
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4. DRILLING METHOD _____ cable, _____ bored, _____ ☒ forward rotary, _____ reverse rotary, _____ jetted, _____ other (specify) _____ 5. WELL CONSTRUCTION AND COMPLETION <table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th>Size of drilled hole</th> <th>Size and weight of casing</th> <th>From (feet)</th> <th>To (feet)</th> <th>Perforations Screen</th> <th>Kind Size</th> <th>From (feet)</th> <th>To (feet)</th> </tr> </thead> <tbody> <tr> <td>7 7/8"</td> <td>6 5/8" OD Sch 40</td> <td>1' above</td> <td>36'</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>5 5/8"</td> <td>4 1/2" OD Sch 40 Steel</td> <td>2' above</td> <td>313'</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>4 3/4"</td> <td>2 3/8" OD Sch 40 Steel</td> <td>2' above</td> <td>410'</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>3 7/8"</td> <td>2 1/8" OD Sch 40 Steel</td> <td>410'</td> <td>720'</td> <td>318"</td> <td>600'</td> <td>720'</td> <td></td> </tr> </tbody> </table> Was casing left open end? ☒ Yes ☐ No Was a packer or seal used? ☒ Yes ☐ No If so, what material <u>Rubber</u> Was the well gravel packed? ☒ Yes ☐ No Was the well grouted? ☒ Yes ☐ No To what depth? <u>300'</u> Material used in grouting <u>cement</u> Well head completion: Pitless adapter _____ 12 in. above grade ☒ other _____ (if other, specify) _____ Pump horsepower _____, pump type _____ Pump intake level _____ feet below land surface Power (electric, diesel, etc.) _____	Size of drilled hole	Size and weight of casing	From (feet)	To (feet)	Perforations Screen	Kind Size	From (feet)	To (feet)	7 7/8"	6 5/8" OD Sch 40	1' above	36'					5 5/8"	4 1/2" OD Sch 40 Steel	2' above	313'					4 3/4"	2 3/8" OD Sch 40 Steel	2' above	410'					3 7/8"	2 1/8" OD Sch 40 Steel	410'	720'	318"	600'	720'		11. DRILLER'S CERTIFICATION This well was drilled under my jurisdiction and this report is true to the best of my knowledge. <u>Dec. 18, 1980</u> Date Firm Name <u>Singley Drilling</u> Address <u>R. 2, Box 2007 Lewistown,</u> <u>Wesley O. Singley</u> 398 Signature License No.																																																																
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MONTANA DEPARTMENT OF NATURAL RESOURCES & CONSERVATION

32 SOUTHEWING

HELENA, MONTANA 59601

449-3634

DNRC

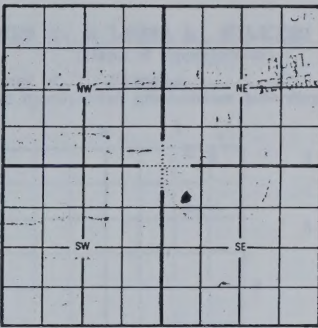
Prior log number 506

DEPARTMENT COPY

WL. 510

1. WELL OWNER Leora Wilkins
Name Leora Wilkins

2. CURRENT MAILING ADDRESS
106 E. Lake
Lewistown, MT 59457

3. WELL LOCATION

SE 1/4 NW 1/4 1/4 Section 7
Township 15 N Range 19 E
County Fergus Block
Subdivision
Well Elevation
Accuracy: ± 10' ± 50' ± 100'

4. DRILLING METHOD cable, bored,
X forward rotary, reverse rotary, jettied,
other (specify)

5. WELL CONSTRUCTION AND COMPLETION

Size of drilled hole	Size and weight of casing of casing	From (feet)	To (feet)	Perforations Screen	Kind Size	From (feet)	To (feet)
<u>7 7/8</u>	<u>6 5/8" OD</u>	<u>1460</u>	<u>36</u>	<u>X</u>	<u>3/8"</u>	<u>440</u>	<u>612</u>
<u>5 5/8</u>	<u>Sch 40</u>	<u>212</u>	<u>313</u>				
<u>4 3/4</u>	<u>4 1/2" Sch 40 steel</u>	<u>300</u>	<u>612</u>				

Was casing left open end? X Yes No
Was a packer or seal used? X Yes No
If so, what material rubber
Was the well gravel packed? Yes X No
Was the well grouted? X Yes No
To what depth? 312 ft
Material used in grouting cement
Well head completion: Pitless adapter
12 in. above grade X other
(if other, specify)
Pump horsepower , pump type
Pump intake level feet below land surface
Power (electric, diesel, etc.)

6. WATER LEVEL
Static water level feet below land surface
If flowing, closed-in pressure psi
2 gpm flow through 1 1/2 inch pipe
Controlled by: valve, reducers, other
(if other, specify)

7. WELL TEST DATA pump bailer other
(if other, specify)
Pumping level below land surface:
 ft. after hrs. pumping gpm
 ft. after hrs. pumping gpm

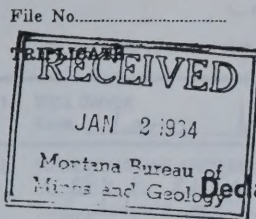
8. WAS WELL PLUGGED OR ABANDONED? Yes X No
If yes, how?

9. DATE STARTED 16 Sept 1980
DATE COMPLETED 8 Oct 1980

10. WELL LOG
Depth (ft.)
From To Formation
0 8 Surface Drift
8 36 Gravel
36 42 Rock Sandstone
42 43 Rock
43 77 Sandstone w/shale
77 172 Red beds
172 187 Sandstone
187 224 Red beds
224 240 White sandstone
240 265 White Sandstone water
265 272 Red beds
272 308 Gray sand
308 346 red beds
346 360 Gray sand
360 432 Red beds
432 434 Hard Rock
434 510 White Sand
510 512 Coal
512 538 Dark Sand
538 540 Coal
540 612 Dark Sand w/coal

11. DRILLER'S CERTIFICATION
This well was drilled under my jurisdiction and this report is true to the best of my knowledge.
10/14/80
Singley Drilling
Firm Name
R. 2, Box 2007
Address
Wesley O. Singley
Signature
398
License No.

MONTANA DEPARTMENT OF NATURAL RESOURCES & CONSERVATION
32 SOUTH EWING HELENA, MONTANA 59601 449-3634 **DNRC**

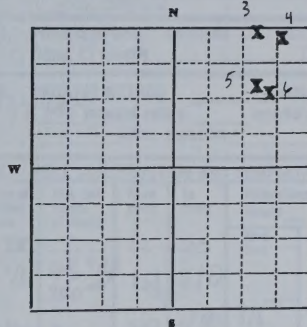


STATE OF MONTANA
ADMINISTRATOR OF GROUNDWATER CODE
OFFICE OF STATE ENGINEER

Declaration of Vested Groundwater Rights

(Under Chapter 237, Montana Session Laws, 1961)

1. **JAMES C. & LEOBA L. WILKINS**, of **Lewistown**
(Name of Appropriator) (Address) (Town)
County of **Fergus** State of **Montana**
have appropriated groundwater according to the Montana laws in effect prior to January 1, 1962, as follows:



NE 1/4 NE Sec. 7 T. 15 R. 19

Indicate point of appropriation
and place of use, if possible.
Each small square represents 10
acres.

2. The beneficial use on which the claim is based
domestic use and livestock

3. Date or approximate date of earliest beneficial use; and how con-
tinuous the use has been **before 1900 - continuous use**
3 flowing springs - one dug well

4. The amount of groundwater claimed (in miner's inches or gallons
per minute) **each spring - 4 gallons per minute**
well - all water

5. If used for irrigation, give the acreage and description of the lands
to which water has been applied and name of the owner thereof
none

6. The means of withdrawing such water from the ground and the
location of each well or other means of withdrawal **flowing**
springs - pump on well - springs are dug out
and improved - pipe to water tanks

7. The date of commencement and completion of the construction of the well, wells, or other works for with-
drawal of groundwater **latest improvement - 1961 - springs dug out 10 feet -**
perforated pipe buried in gravel and run to water tanks

8. The depth of water table **10 feet**

9. So far as it may be available, the type, size and depth of each well or the general specifications of any other
works for the withdrawal of groundwater
three improved springs - dug well with pump

10. The estimated amount of groundwater withdrawn each year **over 1 million gallon each spring**

11. The log of formations encountered in the drilling of each well if available.
none

12. Such other information of a similar nature as may be useful in carrying out the policy of this act, including
reference to book and page of any county record
springs and well have been in use since early days - have been
improved from time to time

Signature of Owner **James C. Wilkins**
Leoba L. Wilkins
Date **December 28, 1963**

Three copies to be filed by the owner with the County Clerk and Recorder of the county in which the well is
located.

Please answer all questions. If not applicable, so state, otherwise the form will be returned.

Original to the County Clerk and Recorder; duplicate to the State Engineer; Triplicate to the Montana Bureau
of Mines and Geology, and Quadruplicate for the Appropriator.

CODED WELL LOG REPORT

State law requires that this form be filed by the water well driller within 60 days after completion

005601

1. WELL OWNER Name <u>Leora Wilkins</u>			8. WATER LEVEL Static water level <u>0</u> feet below land surface If flowing; closed-in pressure _____ psi _____ gpm Controlled by: _____ valve, _____ reducers, other, (specify) _____		
2. CURRENT MAILING ADDRESS <u>106 F. Lake</u> <u>Lewistown, MT 59457</u>			9. WELL TEST DATA pump _____ bailer _____ other, (specify) <u>air</u> Pumping level below land surface: <u>100</u> ft. after <u>1</u> hrs. pumping <u>12</u> gpm ft. after _____ hrs. pumping _____ gpm		
3. WELL LOCATION County <u>Fergus</u> Township <u>15</u> N/R Range <u>19</u> E/W Lot <u>SE 1/4 NW 1/4</u> Section <u>7</u> Block _____ Subdivision _____			10. WAS WELL PLUGGED OR ABANDONED? Yes ☒ No ☐ If yes, how? _____		
4. PROPOSED USE: Domestic ☐ Stock ☒ Irrigation ☐ Other ☐ specify _____			11. DATE COMPLETED <u>Sept 22 1982</u>		
5. DRILLING METHOD cable, _____ bored, _____ ☒ forward rotary, _____ reverse rotary, _____ jetted, _____ other (specify) _____			12. WELL LOG Depth (ft.) From To Formation		
6. WELL CONSTRUCTION AND COMPLETION					
Size of drilled hole	Size and weight of casing	From (feet)	To (feet)	Perforations	
				Screen	and/or
				Kind	From
				Size	To
					(feet)
<u>2 7/8</u>	<u>0</u>	<u>20</u>			
<u>5 5/8</u>	<u>4 1/2" OD</u>	<u>100</u>	<u>310</u>		
	<u>200</u>				
<u>4 3/4</u>	<u>2</u>	<u>310</u>	<u>490</u>	<u>3 1/8" hole</u>	<u>270'</u> <u>310'</u>
Was casing left open end? ☒ Yes _____ No _____ Was a packer or seal used? ☒ Yes _____ No _____ If so, what material <u>rubber</u> Was the well gravel packed? _____ Yes ☒ No _____ Was the well grouted? ☒ Yes _____ No _____ To what depth? <u>20'</u> Material used in grouting <u>cement</u> Well head completion: Pitless adapter _____ Top of casing 12 in. or greater above grade ☒ Yes _____ No _____					
7. WHAT IS THE TEMPERATURE OF THE WATER? Degrees Fahrenheit ☐ Measured ☐ Estimated					
13. DRILLER'S CERTIFICATION This well was drilled under my jurisdiction and this report is true to the best of my knowledge. <u>18 Oct, 1982</u> Date <u>Single Drilling</u> Firm Name <u>1016 W. Broadway, Lewistown, MT</u> Address <u>Wally O. Single</u> Signature <u>398</u> License No.					

MONTANA DEPARTMENT OF NATURAL RESOURCES & CONSERVATION

32 SOUTH EWING

HELENA, MONTANA 59620

449-3962

DNRC

artcraft printers of missoula

DEPARTMENT COPY

061437

State law requires that this form be filed by the water well driller within 60 days after completion.

MONTANA DEPARTMENT OF NATURAL RESOURCES & CONSERVATION

1520 EAST SIXTH AVENUE

HELENA, MONTANA 59620-2301

444-6610

DNRC

1. WELL OWNER Name <u>Charlie Karinen</u>	8. WATER LEVEL Static water level <u>0</u> feet below land surface If flowing; closed-in pressure <u>0</u> psi Controlled by: <u>4.5</u> gpm ☒ other, (specify) <u>seal</u> valve, reducers,																																								
2. CURRENT MAILING ADDRESS <u>Gilt Edge Rd</u> <u>Lewistown, MT 59457</u>	9. WELL TEST DATA <u>---</u> pump <u>---</u> bailer ☒ other, (specify) <u>air</u> Pumping water level below land surface: <u>23.0</u> ft. after <u>1/2</u> hrs. pumping <u>2.0</u> gpm <u>2.0</u> ft. after <u>1/2</u> hrs. pumping <u>6.5</u> gpm																																								
3. WELL LOCATION County <u>Fergus</u> Township <u>15</u> N <u>18</u> E Range <u>19</u> E <u>20</u> W Lot <u>NW 1/4 NE 1/4</u> Section <u>18</u> Subdivision <u>SW</u> Block <u>---</u>	10. WAS WELL PLUGGED OR ABANDONED? Yes ☒ No ☐ If yes, how? <u>---</u>																																								
4. PROPOSED USE Domestic ☒ Stock ☐ Irrigation ☐ Other ☐ specify <u>---</u>	11. DATE COMPLETED <u>9/12/86</u>																																								
5. DRILLING METHOD <u>---</u> cable, <u>---</u> bored, ☒ forward rotary, <u>---</u> reverse rotary, <u>---</u> jetted, other (specify) <u>---</u>	12. WELL LOG Depth (ft.) From To Formation <table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td>0</td><td>30</td><td>shale w/ rust sandstone</td></tr> <tr><td>30</td><td>33</td><td> Bentonite</td></tr> <tr><td>33</td><td>37</td><td> Coal</td></tr> <tr><td>37</td><td>48</td><td> Grey shale</td></tr> <tr><td>48</td><td>52</td><td> Limestone</td></tr> <tr><td>52</td><td>72</td><td> Varied shale</td></tr> <tr><td>72</td><td>78</td><td> Hard limestone</td></tr> <tr><td>78</td><td>119</td><td> shale w/ hard layers</td></tr> <tr><td>119</td><td>121</td><td> white rock & clay</td></tr> <tr><td>121</td><td>124</td><td> Brown shale</td></tr> <tr><td>124</td><td>215</td><td> Dark varied shale w/ 1'-3' layers of limestone</td></tr> <tr><td>215</td><td>262</td><td> limestone</td></tr> <tr><td>262</td><td>---</td><td> Green sandstone</td></tr> </table>	0	30	shale w/ rust sandstone	30	33	Bentonite	33	37	Coal	37	48	Grey shale	48	52	Limestone	52	72	Varied shale	72	78	Hard limestone	78	119	shale w/ hard layers	119	121	white rock & clay	121	124	Brown shale	124	215	Dark varied shale w/ 1'-3' layers of limestone	215	262	limestone	262	---	Green sandstone	
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Was casing left open end? ☒ Yes ☐ No Was a packer or seal used? ☒ Yes ☐ No If so, what material <u>rubber</u> Was the well gravel packed? ☐ Yes ☒ No Was the well grouted? ☒ Yes ☐ No To what depth? <u>200</u> Material used in grouting <u>cement</u> Well head completion: Pitless adapter <u>---</u> Top of casing 12 in. or greater above grade ☒ Yes ☐ No ☒ Yes ☐ No																																									
7. WHAT IS THE TEMPERATURE OF THE WATER? <u>L</u> Degrees Fahrenheit ☒ Measured ☐ Estimated																																									
13. DRILLER'S CERTIFICATION MONTANA D.N.R.C. This well was drilled under my supervision and this report is true to the best of my knowledge. <u>9/13/86</u> Date <u>Singley Drilling</u> Firm Name <u>1096 W. Broadway, Lewistown,</u> Address <u>Wesley S. Singley</u> Signature <u>398</u> License No.																																									

MONTANA DEPARTMENT OF NATURAL RESOURCES & CONSERVATION

32 SOUTH EWING HELENA, MONTANA 59620 444-6610

DNRC

code

1. WELL OWNER: Name <u>Pat Henderson</u>	2. CURRENT MAILING ADDRESS <u>Gilt Edge Route</u> <u>Jewettville, Montana 59457</u>																
3. PROPOSED USE: _____ domestic (includes lawn and garden); _____ stock; _____ municipal; _____ industrial; irrigation; other (specify) _____																	
4. WELL LOCATION A 10x10 grid with labels NW at top-left, NE at top-right, SW at bottom-left, and SE at bottom-right. The intersection of the 5th vertical line from left and 5th horizontal line from top contains a dot representing the well location. NW ¼ NW ¼ = ½ ¼ Section <u>18</u> T. <u>15 North</u> R. <u>19 East</u> OR S Or N Block _____ City _____ County <u>Fergus</u> Elevation _____ Accuracy: ±10'; ±50'; ±100'																	
5. DRILLING METHOD cable, bored, ☒ forward rotary, reverse rotary, jetted, other (specify) _____																	
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Size of drilled hole	Size and weight of casing	From (feet)	To (feet)	Perforations Screen	Kind Size	From (feet)	To (feet)										
6 3/4"	5" 160 psi	0	40	X and/or	3/8" holes	20'	40'										
7. WATER LEVEL Static water level <u>10'</u> feet below land surface If flowing, closed-in pressure _____ psi _____ gpm flow through _____ inch pipe Controlled by: valve, reducers, other (if other, specify) _____																	
8. WELL TEST DATA pump ☒ bailer other _____ (if other, specify) Pumping level below land surface: <u>15' ft.</u> after <u>1/2 hrs.</u> pumping <u>15' gpm</u> ft. after _____ hrs. pumping _____ gpm																	
9. WAS WELL PLUGGED OR ABANDONED? Yes ____ No ____ If yes, how? _____																	
10. DATE STARTED <u>4/20/78</u> DATE COMPLETED <u>4/20/78</u>																	
11. WELL LOG <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="2">Depth (ft.)</th> <th>Formation</th> </tr> <tr> <th>From</th> <th>To</th> <th></th> </tr> </thead> <tbody> <tr> <td>0</td> <td>40</td> <td>Topsail & clay</td> </tr> <tr> <td>4</td> <td>40</td> <td>gravel & rocks</td> </tr> </tbody> </table>		Depth (ft.)		Formation	From	To		0	40	Topsail & clay	4	40	gravel & rocks				
Depth (ft.)		Formation															
From	To																
0	40	Topsail & clay															
4	40	gravel & rocks															
12. DRILLER'S CERTIFICATION This well was drilled under my jurisdiction and this report is true to the best of my knowledge. <u>4/20/78</u> Date <u>DeBuff Dilling</u> Firm Name <u>Route 2 Box 185 Jewettville MT.</u> Address <u>Martin J. DeBuff</u> Signature License No. _____																	

State law requires that the Bureau's copy be filed by the water well driller within 60 days after completion of the well.

PER 602.
5-13-93. 51

1. WELL OWNER Name <u>Pat Henderson</u>		f) Duration of test: Pumping time <u>1</u> hrs. g) Recovery time <u>25</u> hrs. h) Recovery water level <u>16</u> ft. at <u>25</u> hrs. after pumping stopped.	
2. CURRENT MAILING ADDRESS <u>Bilt Edge Rt</u> <u>Louisiana, 72759457</u>		Wells intended to yield 100 gpm or more shall be tested for a period of 8 hours or more. The test shall follow the development of the well, and shall be conducted continuously at a constant discharge at least as great as the intended appropriation. In addition to the above information, water level data shall be collected and recorded on the Department's "Aquifer Test Data" form. NOTE: All wells shall be equipped with an access port 1/2 inch minimum or a pressure gauge that will indicate the shut-in pressure of a flowing well. Removable caps are acceptable as access ports.	
3. WELL LOCATION <u>NW 1/4 NW 1/4 NW 1/4</u> Section <u>18</u> Township <u>15</u> N Range <u>19</u> E County <u>Fergus</u> Gov't Lot _____, or Lot _____ Block _____ Subdivision Name _____ Tract Number _____		11. WAS WELL PLUGGED OR ABANDONED? Yes ☒ No ☐ If yes, how? _____	
4. PROPOSED USE: Domestic ☒ Stock ☐ Irrigation ☐ Other ☐ specify _____		12. WELL LOG Depth (ft.) From To Formation <u>0</u> <u>54</u> <u>Topsoil</u> <u>1</u> <u>54</u> <u>Clay</u> <u>4</u> <u>54</u> <u>Gravel & sand</u> <u>50</u> <u>54</u> <u>White & Green sandy shale</u>	
5. TYPE OF WORK: New well ☒ Method: Dug ☐ Bored ☐ Deepened ☐ Cable ☐ Driven ☐ Reconditioned ☐ Rotary ☐ Jetted ☐		DC	
6. DIMENSIONS: Diameter of Hole Dia. <u>9 1/8</u> in. from <u>0</u> ft. to <u>54</u> ft. Dia. _____ in. from _____ ft. to _____ ft. Dia. _____ in. from _____ ft. to _____ ft.			
7. CONSTRUCTION DETAILS: Casing: Steel Dia. <u>6 5/8</u> from <u>11.5</u> ft. to <u>19</u> ft. Threaded ☒ Welded ☐ Dia. _____ from _____ ft. to _____ ft. Type <u>API</u> Wall Thickness <u>.25</u> Casing: Plastic Dia. <u>6 5/8</u> from <u>19</u> ft. to <u>54</u> ft. Weight <u>160 PSI</u> Dia. _____ from _____ ft. to _____ ft. PERFORATIONS: Yes ☒ No ☐ Type of perforator used <u>3/8 Drill</u> Size of perforations <u>8 Row</u> in. by <u>12</u> in. <u>1</u> perforations from <u>25</u> ft. to <u>54</u> ft. _____ perforations from _____ ft. to _____ ft. _____ perforations from _____ ft. to _____ ft.			
SCREENS: Yes ☐ No ☒ Manufacturer's Name _____ Type _____ Model No. _____ Dia. _____ Slot size _____ from _____ ft. to _____ ft. Dia. _____ Slot size _____ from _____ ft. to _____ ft.			
GRAVEL PACKED: Yes ☐ No ☒ Size of gravel _____ Gravel placed from _____ ft. to _____ ft.			
GROUDED: To what depth? <u>25</u> ft. Material used in grouting <u>Cement & Bent</u>			
8. WELL HEAD COMPLETION: Pitless Adapter ☒ Yes ☐ No			
9. PUMP (if installed) Manufacturer's name <u>Goulds</u> Type <u>Sub</u> Model No. <u>10EJOS412 1/2</u>			
10. WELL TEST DATA The information requested in this section is required for all wells. All depth measurements shall be from the top of the well casing. All wells under 100 gpm must be tested for a minimum of one hour and provide the following information: a) Air ☒ Pump _____ Bailor _____ b) Static water level immediately before testing <u>16</u> ft. If flowing, closed-in pressure _____ psi. _____ gpm. Flow controlled by: _____ valve, _____ reducers, _____ other, (specify) _____ c) Depth at which pump is set for test <u>35</u> d) The pumping rate: <u>30</u> gpm. e) Pumping water level: <u>30</u> ft. at <u>25</u> hrs. after pumping began.		13. DATE COMPLETED <u>4/6/93</u>	
		14. DRILLER/CONTRACTOR'S CERTIFICATION This well was drilled under my jurisdiction and this report is true to the best of my knowledge. <u>4/6/93</u> <u>Single Drilling</u> Firm Name <u>R2 Box 3006, Louisiana</u> Address <u>Walter J. King</u> Signature <u>398</u> License No.	

 MONTANA DEPARTMENT OF NATURAL RESOURCES & CONSERVATION
 1520 EAST SIXTH AVENUE HELENA, MONTANA 59620-2301 444-6810

DNRC

DEPARTMENT COPY

 DRILLER: Please give this copy to the well owner to complete reverse side.
 OWNER: Complete reverse side and send to DNRC when the well is completed and the water has been used beneficially for the intended purpose.

M:13440

Department of Natural Resources and Conservation

WELL LOG REPORT

White-Department
Pink-Bureau
Yellow-Well owner
Gold-Driller

State law requires that this form be filed by the water well driller within 60 days after completion of the well, and Form 603, Notice of Completion of Groundwater Development, be filed by the well owner within 60 days after the water has been put to beneficial use.

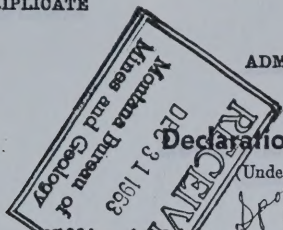
1. WELL OWNER Name <u>Ruth H. E. Ager</u> Current address <u>Alt Edge Stage</u> <u>Lewis Town, Montana 59405</u>	
2. WELL LOCATION Lot <u>15</u> Block <u>15</u> Subdivision <u>15</u> County <u>Fergus</u> or <u>San Juan</u> Sec. <u>18</u> T. <u>15</u> N-S, R. <u>19</u> W	
3. PROPOSED USE ☒ domestic (includes lawn and garden); ☒ stock; ☐ municipal; ☐ industrial; ☐ irrigation; other (specify) <u>other</u>	
4. METHOD DRILLED cable, bored, ☒ forward rotary, ☐ reverse rotary, jetted, other (specify) <u>other</u>	
5. WELL CONSTRUCTION Diameter of hole <u>5 1/2</u> in.; depth <u>120</u> ft. Casing: ☐ steel, ☒ plastic, ☐ concrete, threaded, welded, other (specify) <u>other</u> Pipe weight: Dia. From To <u>3.44</u> lb/ft <u>4</u> in. <u>0</u> ft. <u>120</u> ft. lb/ft <u>4</u> in. <u>0</u> ft. <u>120</u> ft. Was casing left open end? ☒ Yes ☐ No Was a well screen installed? ☐ Yes ☒ No Material <u>stainless steel</u> , dia. <u>4</u> in. (stainless steel, bronze, etc.) Was perforated pipe used? ☒ Yes ☐ No Perforation type: ☐ slots ☒ holes Size <u>5/16</u> set from <u>95</u> ft. to <u>120</u> ft. Size <u>5/16</u> set from <u>95</u> ft. to <u>120</u> ft. Was a packer or seal used? ☒ Yes ☐ No If so, what material <u>Rubber</u> Well type: ☒ Straight screen ☐ Graveled Was the well grouted: ☒ Yes ☐ No To what depth: <u>95</u> ft. Material used in grouting <u>Concrete</u> Well head completion: Pitless adapter ☒ 12 in. above grade, other (if other, specify) Was well disinfected? ☐ Yes ☒ No	
6. WATER LEVEL <u>psi = 7.42 on 8/20/80</u> Static water level <u>70</u> ft. below land surface If flowing: closed-in pressure <u>70</u> psi gpm flow <u>95</u> through <u>2</u> inch pipe Controlled by: ☒ valve ☐ reducers other (specify) <u>other</u>	
7. WELL TEST DATA Pump ☒ Bailer ☐ Other (if other, specify) <u>Flowing Well</u> Pumping level below land surface: ft. after <u>1</u> hrs. pumping <u>594</u> gpm ft. after <u>1</u> hrs. pumping <u>594</u> gpm	
8. WELL LOG Depth (ft.) From To Formation <u>217KOT</u> <u>0</u> <u>15</u> <u>Red shale and gray</u> <u>15</u> <u>45</u> <u>Red shale and gray</u> <u>45</u> <u>120</u> <u>Red shale and gray</u> <u>120</u> <u>120</u> <u>Sandstone</u>	
9. DATE STARTED <u>Oct. 22, 1976</u> DATE COMPLETED <u>Oct. 27, 1976</u>	
10. WAS WELL PLUGGED OR ABANDONED? ☐ Yes ☒ No If so, how?	
11. DRILLER'S CERTIFICATION This well was drilled under my jurisdiction and this report is true to the best of my knowledge. <u>George O. Singly, Driller</u> Driller's or firm name License No. <u>594</u> Address <u>Box 4 Livingston, Mont.</u> Signed by <u>George O. Singly</u> date <u>Jan. 10, 1977</u> M: 196	

File No. 17176T 15 R 18

TRIPLICATE

County Fergus

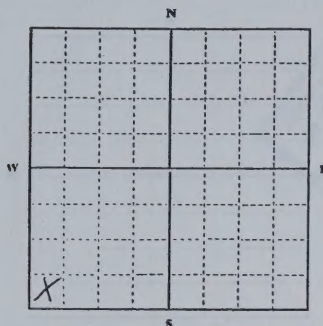
STATE OF MONTANA
ADMINISTRATOR OF GROUNDWATER CODE
OFFICE OF STATE ENGINEER



Declaration of Vested Groundwater Rights

(Under Chapter 237, Montana Session Laws, 1961)

I, William A. Spoja, of Leviestown (Address) (Town)
(State of Appropriator)
County of Fergus State of Montana
have appropriated groundwater according to the Montana laws in effect prior to January 1, 1962, as follows:



SW 1/4 Sec. 12 T. 15 R. 18 E

Indicate point of appropriation and place of use, if possible. Each small square represents 10 acres.

2. The beneficial use on which the claim is based water for household use including garden and house area, stock water

3. Date or approximate date of earliest beneficial use; and how continuous the use has been Approximate date of development is 1889. Well has been in continuous use since that time.

4. The amount of groundwater claimed (in miner's inches or gallons per minute) 10 gallons per minute

5. If used for irrigation, give the acreage and description of the lands to which water has been applied and name of the owner thereof
Irrigation use - one acre; SW 1/4 S 12 T 15 R 18 E
Owner: William Spoja
Leviestown, Montana

6. The means of withdrawing such water from the ground and the location of each well or other means of withdrawal
Electric pump

7. The date of commencement and completion of the construction of the well, wells, or other works for withdrawal of groundwater 1889-initial digging and use
1938-re-cased with cement casing, brought to present condition.

8. The depth of water table twelve (12) feet

9. So far as it may be available, the type, size and depth of each well or the general specifications of any other works for the withdrawal of groundwater
type - hand dug
size - 36 inch cement casing
depth - twenty-two (22) feet

10. The estimated amount of groundwater withdrawn each year 1,500,000 gallons

11. The log of formations encountered in the drilling of each well if available
No formal log; gravel formation encountered.

12. Such other information of a similar nature as may be useful in carrying out the policy of this act, including reference to book and page of any county record none known in reference to underground water.

Signature of Owner William A. Spoja

Date Dec 29, 1966

Three copies to be filed by the owner with the County Clerk and Recorder of the county in which the well is located.

Please answer all questions. If not applicable, so state, otherwise the form will be returned.

Original to the County Clerk and Recorder; Duplicate to the State Engineer; Triplicate to the Montana Bureau of Mines and Geology, and Quadruplicate to the Appropriator.

17177

File No.

T. 15 R. 18

TRIPLICATE

County Levi

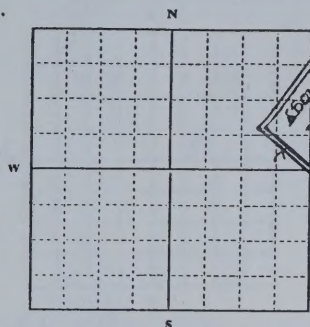
STATE OF MONTANA
ADMINISTRATOR OF GROUNDWATER CODE
OFFICE OF STATE ENGINEER

Declaration of Vested Groundwater Rights

(Under Chapter 237, Montana Session Laws, 1961)

1. William A. Spaja, of Levi
(Name of Appropriator) (Address) (Town)

County of Fergus State of Montana
have appropriated groundwater according to the Montana laws in effect prior to January 1, 1962, as follows:



The beneficial use on which the claim is based Stock water and water for irrigation

Date of approximate date of earliest beneficial use; and how continuous the use has been 1900; this well is relied upon for especially during periods of drought

The amount of groundwater claimed (in miner's inches or gallons per minute) 5 gallons per minute

5. If used for irrigation, give the acreage and description of the land to which water has been applied and name of the owner there:

1 acre garden SE 1/4 Sec. 12 T. 15 R. 18E

Owner: William A. Spaja
Levi, Montana

6. The means of withdrawing such water from the ground and the location of each well or other means of withdrawal

pump located at well

SE 1/4 NE 1/4 Sec. 12 T. 15 R. 18E

Indicate point of appropriation and place of use, if possible. Each small square represents 10 acres.

7. The date of commencement and completion of the construction of the well, wells, or other works for withdrawal of groundwater 1900

8. The depth of water table twelve (12) feet

9. So far as it may be available, the type, size and depth of each well or the general specifications of any other works for the withdrawal of groundwater

type hand dug
size 28" casing
depth 25 feet

10. The estimated amount of groundwater withdrawn each year 400,000 gallons

11. The log of formations encountered in the drilling of each well if available none available

12. Such other information of a similar nature as may be useful in carrying out the policy of this act, including reference to book and page of any county record none known

Signature of Owner William A. Spaja

Date Dec 27 1961

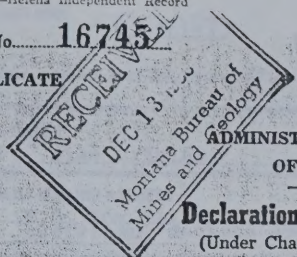
Three copies to be filed by the owner with the County Clerk and Recorder of the county in which the well is located

Please answer all questions. If not applicable, so state, otherwise the form will be returned.

Original to the County Clerk and Recorder; Duplicate to the State Engineer; Triplicate to the Montana Bureau of Mines and Geology, and Quadruplicate for the Appropriator.

File No. **16745**

TRIPPLICATE

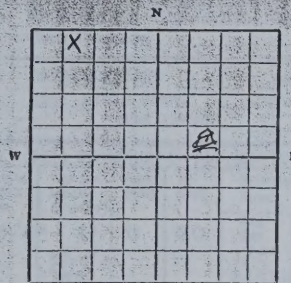


STATE OF MONTANA
ADMINISTRATOR OF GROUNDWATER CODE
OFFICE OF STATE ENGINEER

T. 15 R. 18
County Fergus

Declaration of Vested Groundwater Rights
(Under Chapter 237, Montana Session Laws, 1961)

1. J. C. McDonald (Name of Appropriator), of P.O. Box 390 Livingston (Address) (Town)
County of Fergus State of Montana
have appropriated groundwater according to the Montana laws in effect prior to January 1, 1962, as follows:



NW NW
Sec. 12 T. 15 R. 18

Indicate point of appropriation and place of use, if possible. Each small square represents 10 acres.

2. The beneficial use on which the claim is based
#1 house use #2 cattle well
3. Date or approximate date of earliest beneficial use; and how continuous the use has been
#1 - 1915
#2 - 1948
4. The amount of groundwater claimed (in miner's inches or gallon per minute) don't know
5. If used for irrigation, give the acreage and description of the lands to which water has been applied and name of the owner thereof no irrigation
6. The means of withdrawing such water from the ground and the location of each well or other means of withdrawal
#1 Pump
#2 Artesian flow
7. The date of commencement and completion of the construction of the well, wells, or other works for withdrawal of groundwater don't know - estimating
8. The depth of water table don't know
9. So far as it may be available, the type, size and depth of each well or the general specifications of any other works for the withdrawal of groundwater
#1 dug - 25 ft deep - depth 100 ft flow - estimated at 80 gals per minute
#2 drilled by Catlett
10. The estimated amount of groundwater withdrawn each year don't know
11. The log of formations encountered in the drilling of each well if available
could possibly contact Catlett for log on artesian well
12. Such other information of a similar nature as may be useful in carrying out the policy of this act, including reference to book and page of any county record.

Signature of Owner J. C. McDonald
Date 11-22-63

Three copies to be filed by the owner with the County Clerk and Recorder of the county in which the well is located.

Please answer all questions. If not applicable, so state, otherwise the form will be returned.

Original to the County Clerk and Recorder; duplicate to the State Engineer; Triplicate to the Montana Bureau of Mines and Geology and Quadruplicate for the Appropriator.

CODED

WELL LOG REPORT

File No.

0055E

State law requires that this form be filed by the water well driller within 60 days after completion.

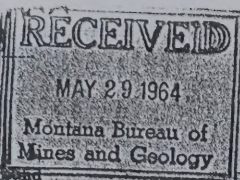
1. WELL OWNER Name <u>Mike Crimins</u> 2. CURRENT MAILING ADDRESS <u>P.O. Box 544</u> <u>Lewistown, Montana 49457</u> 3. WELL LOCATION County <u>Fergus</u> Township <u>15</u> N ☒ Range <u>18</u> E ☒ Lot <u>1/4 W 1/4 NE 1/4</u> Section <u>13</u> Subdivision _____ 4. PROPOSED USE Domestic ☒ Stock ☐ Irrigation ☐ Other ☐ specify _____ 5. DRILLING METHOD _____ cable, _____ bored, ☒ forward rotary, _____ reverse rotary, _____ jetted, other (specify) _____ 6. WELL CONSTRUCTION AND COMPLETION <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Size of drilled hole</th> <th>Size and weight of casing</th> <th>From (feet)</th> <th>To (feet)</th> <th>Perforations Screen</th> <th>Kind Size</th> <th>From (feet)</th> <th>To (feet)</th> </tr> </thead> <tbody> <tr> <td>5/8"</td> <td>4" galv. steel wall</td> <td>0</td> <td>20</td> <td>☒ _____ and/or _____</td> <td>1/8" slots</td> <td>70</td> <td>90</td> </tr> <tr> <td>5/8"</td> <td>4" pvc 160#</td> <td>20</td> <td>100</td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table> Was casing left open end? ☒ Yes ☐ No Was a packer or seal used? ☒ Yes ☐ No If so, what material <u>rubber</u> Was the well gravel packed? ☐ Yes ☒ No Was the well grouted? ☒ Yes ☐ No To what depth? <u>70'</u> Material used in grouting <u>cement</u> Well head completion: Pitless adapter ☐ Yes ☒ No Top of casing 12 in. or greater above grade ☒ Yes ☐ No 7. WHAT IS THE TEMPERATURE OF THE WATER? Degrees Fahrenheit ☐ Measured ☐ Estimated	Size of drilled hole	Size and weight of casing	From (feet)	To (feet)	Perforations Screen	Kind Size	From (feet)	To (feet)	5/8"	4" galv. steel wall	0	20	☒ _____ and/or _____	1/8" slots	70	90	5/8"	4" pvc 160#	20	100					8. WATER LEVEL Static water level <u>30'</u> feet below land surf. If flowing; closed-in pressure _____ gpm Controlled by: _____ valve, _____ reduce other, (specify) _____ 9. WELL TEST DATA _____ pump _____ bailer ☒ other, (specify) <u>air lift</u> Pumping level below land surface: <u>80</u> ft. after <u>1</u> hrs. pumping <u>50</u> gpm _____ ft. after _____ hrs. pumping _____ gpm 10. WAS WELL PLUGGED OR ABANDONED? Yes ☒ If yes, how? _____ 11. DATE COMPLETED <u>5/18/84</u> 12. WELL LOG <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>From</th> <th>To</th> <th>Formation</th> </tr> </thead> <tbody> <tr><td>0</td><td>26</td><td>red shale</td></tr> <tr><td>26</td><td>38</td><td>white & yellow sandstone</td></tr> <tr><td>38</td><td>40</td><td>red shale</td></tr> <tr><td>40</td><td>52</td><td>white sandstone</td></tr> <tr><td>52</td><td>58</td><td>red shale</td></tr> <tr><td>58</td><td>68</td><td>white sandstone</td></tr> <tr><td>68</td><td>70</td><td>rust colored sandstone</td></tr> <tr><td colspan="3" style="text-align: center;">#####</td></tr> <tr><td>70</td><td>77</td><td>red shale</td></tr> <tr><td>77</td><td>90</td><td>white sandstone (water)</td></tr> <tr><td>90</td><td>100</td><td>gravel</td></tr> </tbody> </table> RECEIVED AUG 27 1984 MONTANA D.N.R.C. LEWISTOWN FIELD OFFICE 13. DRILLER'S CERTIFICATION This well was drilled under my jurisdiction and this report true to the best of my knowledge. Date <u>6/4/84</u> Firm Name <u>DeBuff Drilling Co.</u> Address <u>Gilt Edge Rte., Lewistown, Mt</u> Signature <u>Mark J. DeBuff</u> License No. <u>346</u>	From	To	Formation	0	26	red shale	26	38	white & yellow sandstone	38	40	red shale	40	52	white sandstone	52	58	red shale	58	68	white sandstone	68	70	rust colored sandstone	#####			70	77	red shale	77	90	white sandstone (water)	90	100	gravel
Size of drilled hole	Size and weight of casing	From (feet)	To (feet)	Perforations Screen	Kind Size	From (feet)	To (feet)																																																						
5/8"	4" galv. steel wall	0	20	☒ _____ and/or _____	1/8" slots	70	90																																																						
5/8"	4" pvc 160#	20	100																																																										
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#####																																																													
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77	90	white sandstone (water)																																																											
90	100	gravel																																																											

MONTANA DEPARTMENT OF NATURAL RESOURCES & CONSERVATION **DNRC**

32 SOUTH EWING
HELENA, MONTANA 59620
449-3962

DEPARTMENT — BUREAU COPY.

File No. 19393



TRIPLICATE

MAY 29 1964

Montana Bureau of
Mines and Geology

STATE OF MONTANA
ADMINISTRATOR OF GROUNDWATER CODE
OFFICE OF STATE ENGINEER

County Levi

53

Top of Ground

(Elev. above sea level.....)

Notice of Completion of Groundwater Appropriation by Means of Well

(Under Chapter 237, Montana Session Laws, 1961)

1 Topsoil
2 Clay
3 Gravel
4 Water 25'36"

Owner Ed Skibby Address Levi

Driller George D. Singly Address Levi

Date of Notice of Appropriation of Groundwater None

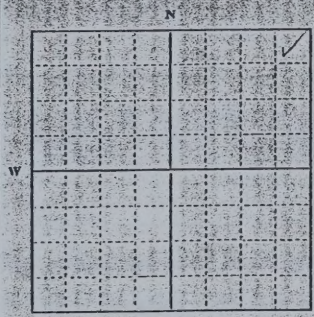
Date well started May 18, 1964 Date Completed May 20, 1964

Type of well drilled Equipment Used Cable Tool
(dug, driven, bored or (Churn, drill, rotary or
drilled) other)

Water Use: Domestic ☐ Municipal ☐ Other ☐ Irrigation
Industrial ☐ Drainage ☐ Stock ☐

Indicate on the diagram the character and thickness of the different strata met with in drilling, such as soil, clay, shale, gravel, rock or sand. Show depth at which water is encountered, thickness and character of water bearing strata and height to which water rises in the well.

Size of Drilled Hole	Size and Weight of Casing	From (Feet)	To (Feet)	PERFORATIONS		
				Kind Size	From (Feet)	To (Feet)
6"	2 1/2 ID 14 1/2	Above Ground	1"			



NE 1/4 Sec. 13 T. 15 R. 12
Indicate location of well and place of use, if possible. Each small square represents 10 acres.

Static Water Level for non-flowing Well 10

Shut-in Pressure for Flowing Well None

Pumping Water Level 30 feet at 50 gal. per min.

Discharge in gal. per min. of flowing well None

How Tested Bailing Length of Test 1 hr.

Remarks: (Gravel packing, cementing, packers, type of shutoff, location of place of use of groundwater if not at well, and other similar pertinent information, including number acres irrigated, if used for irrigation)

drilling casing drive shoe on bottom.

Show exact depth of bottom.

Driller's License Number 519

Driller's Signature George D. Singly

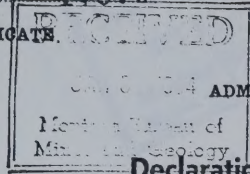
This form to be prepared by driller, and three copies to be filed by the owner with the County Clerk and Recorder in the county in which the well is located.

Please answer all questions. If not applicable, so state, otherwise the form will be returned.

Original to the County Clerk and Recorder; duplicate to the State Engineer; Triuplicate to the Montana Bureau of Mines and Geology and Quadruplicate for the Appropriator.

File No. **17879**T. 15 R. 18

TRIPLICATE

County Terre

STATE OF MONTANA
ADMINISTRATOR OF GROUNDWATER CODE
OFFICE OF STATE ENGINEER

Declaration of Vested Groundwater Rights

(Under Chapter 237, Montana Session Laws, 1961)

1. Edward J. Kelly of Terre Haute, Ind.
(Name of Appropriator) (Address) (Town)
County of Terre Haute State of Indiana
have appropriated groundwater according to the Montana laws in effect prior to January 1, 1962, as follows

N

S

W E

4 1/4 Sec. T. 15 R. 18

Indicate point of appropriation
and place of use, if possible.
Each small square represents 10
acres.

2. The beneficial use on which the claim is based. For water
for irrigation of 7 acres

3. Date or approximate date of earliest beneficial use; and how con-
tinuous the use has been. 1940 - 1960

4. The amount of groundwater claimed (in miner's inches or gallon
per minute). 200 gal per min

5. If used for irrigation, give the acreage and description of the land
to which water has been applied and name of the owner thereof

6. The means of withdrawing such water from the ground and the
location of each well or other means of withdrawal.

7. The date of commencement and completion of the construction of the well, wells, or other works for with-
drawal of groundwater.

8. The depth of water table.

9. So far as it may be available, the type, size and depth of each well or the general specifications of any other
works for the withdrawal of groundwater.

10. The estimated amount of groundwater withdrawn each year.

11. The log of formations encountered in the drilling of each well if available.

12. Such other information of a similar nature as may be useful in carrying out the policy of this act, including
reference to book and page of any county record.

Signature of Owner Edward J. Kelly

Date Jan 7 1962

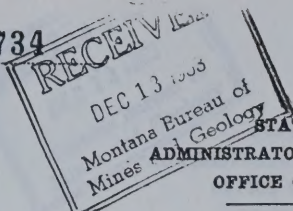
Three copies to be filed by the owner with the County Clerk and Recorder of the county in which the well is
located.

Please answer all questions. If not applicable, so state, otherwise the form will be returned.

Original to the County Clerk and Recorder; duplicate to the State Engineer; Triplicate to the Montana Bureau
of Mines and Geology, and Quadruplicate for the Appropriator.

File No. **16734**

TRIPLICATE

T. **15** R. **18** **131**County **Fergus****(44)**

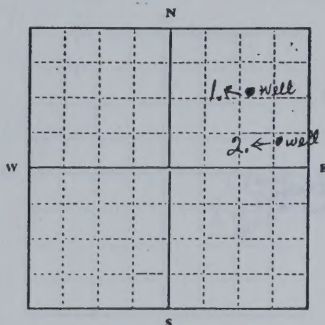
STATE OF MONTANA
ADMINISTRATOR OF GROUNDWATER CODE
OFFICE OF STATE ENGINEER

Declaration of Vested Groundwater Rights

(Under Chapter 237, Montana Session Laws, 1961)

1. **Bernard and or Ethel Lewis**, of **P.O. Box 1094 Lewistown**
(Name of Appropriator) (Address) (Town)

County of **Fergus** State of **Montana**
have appropriated groundwater according to the Montana laws in effect prior to January 1, 1962, as follows



N.E. 1/4 of Sec. 13 T. 15 R. 18

Indicate point of appropriation
and place of use, if possible.
Each small square represents 10
acres.

2. The beneficial use on which the claim is based: **1. well domestic and Stockwater, 2. well Stockwater**

3. Date or approximate date of earliest beneficial use; and how continuous the use has been: **1. well in use since 1900 yr. 2. well in use since 1945 yr.**

4. The amount of groundwater claimed (in miner's inches or gallons per minute): **1. well 5 gal per min. 2. well 5 gal per min.**

5. If used for irrigation, give the acreage and description of the lands to which water has been applied and name of the owner thereof:

Not used for irrigation

6. The means of withdrawing such water from the ground and the location of each well or other means of withdrawal: **1. well pump, 2. well flows natural**

7. The date of commencement and completion of the construction of the well, wells, or other works for withdrawal of groundwater: **1. well in use over 40 yrs. 2. well in use since 1945 yr.**

8. The depth of water table: **1. well near 50 feet - 2. well some 145 feet**

9. So far as it may be available, the type, size and depth of each well or the general specifications of any other works for the withdrawal of groundwater: **1. well drilled cased 5" casing near 50' deep 2. well drilled cased 6" casing near 145' deep**

10. The estimated amount of groundwater withdrawn each year: **unable to state**

11. The log of formations encountered in the drilling of each well if available: **unable to state**

12. Such other information of a similar nature as may be useful in carrying out the policy of this act, including reference to book and page of any county record:

no other information

Signature of Owner: **Bernard Lewis**
Ethel Lewis

Date: **December 11, 1963**

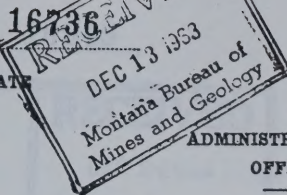
Three copies to be filed by the owner with the County Clerk and Recorder of the county in which the well is located.

Please answer all questions. If not applicable, so state, otherwise the form will be returned.

Original to the County Clerk and Recorder; duplicate to the State Engineer; Triplicate to the Montana Bureau of Mines and Geology, and Quadruplicate for the Appropriator.

File No.

TRIPLICATE



STATE OF MONTANA

ADMINISTRATOR OF GROUNDWATER CODE

OFFICE OF STATE ENGINEER

County Fergus

#1

Declaration of Vested Groundwater Rights

(Under Chapter 237, Montana Session Laws, 1961)

1. Bernard and Ethel Lewis

(Name of Appropriator)

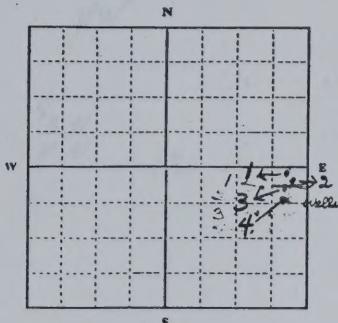
P.O. Box 1094 Lewistown

(Address)

(Town)

County of FergusState of Montana

have appropriated groundwater according to the Montana laws in effect prior to January 1, 1962, as follows



2. The beneficial use on which the claim is based domestic use
2. domestic use - 3. artesian 4. artesian used for farm u
Stock water and etc.

3. Date or approximate date of earliest beneficial use; and how con-
 tinuous the use has been land 2 near 1900 yrs. all time
3. 1945 yrs., 4. near 1915 yrs. all time use.

4. The amount of groundwater claimed (in miner's inches or gallon
 per minute) land 2 enough for domestic use
3. 35 gal per min. 4. 5 gal per min.

5. If used for irrigation, give the acreage and description of the land
 to which water has been applied and name of the owner thereo

Not used for irrigation

6. The means of withdrawing such water from the ground and the
 location of each well or other means of withdrawal land 2. p.h.
3 and 4 flows natural

S.E. 1/4 of Sec. 13 T. 15 R. 18

Indicate point of appropriation
 and place of use, if possible.
 Each small square represents 10
 acres.

7. The date of commencement and completion of the construction of the well, wells, or other works for with-
 drawal of groundwater. land 2 and 4 wells have been in use over 40 yrs.
3 well completed 1945 yrs.

8. The depth of water table. land 2 wells about 24' feet 3 and 4 wells near 150' feet

9. So far as it may be available, the type, size and depth of each well or the general specifications of any other
 works for the withdrawal of groundwater. land 2 wells dug to depth of near 24' diameter 4'
3 well drilled and cased 5" casing 150' deep
4 well drilled and cased 6" casing 150' deep

10. The estimated amount of groundwater withdrawn each year. unable to state

11. The log of formations encountered in the drilling of each well if available. unable to state

12. Such other information of a similar nature as may be useful in carrying out the policy of this act, including
 reference to book and page of any county record.

No other information

Signature of Owner

Bernard Lewis
Ethel LewisDate December 11 - 1963

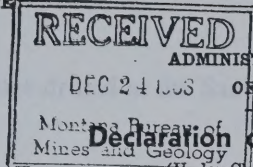
Three copies to be filed by the owner with the County Clerk and Recorder of the county in which the well is
 located.

Please answer all questions. If not applicable, so state, otherwise the form will be returned.

Original to the County Clerk and Recorder; duplicate to the State Engineer; Triplicate to the Montana Bureau
 of Mines and Geology, and Quadruplicate for the Appropriator.

File No. **16948**

TRIPLICATE



STATE OF MONTANA

ADMINISTRATOR OF GROUNDWATER CODE

DEC 24 1963

OFFICE OF STATE ENGINEER

Montana Bureau of
Mines and Geology

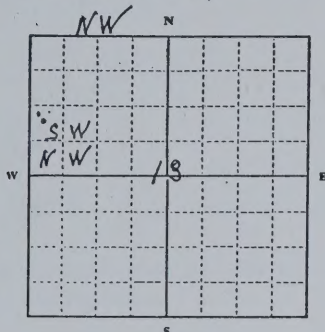
Declaration of Vested Groundwater Rights

(Under Chapter 237, Montana Session Laws, 1961)

T. 15 R. 18County Fergus

1. Ray M. Le Count, or 324 Ridgelm Lewistown
 (Name of Appropriator) (Address) (Town)

County of Fergus State of Montana
 have appropriated groundwater according to the Montana laws in effect prior to January 1, 1962, as follows

SW $\frac{1}{4}$ NW Sec. 13 T. 15 R. 18

Indicate point of appropriation
 and place of use, if possible.
 Each small square represents 10
 acres.

2. The beneficial use on which the claim is based stock and
home stead water supply

3. Date or approximate date of earliest beneficial use; and how con-
 tinuous the use has been around 1893
in continuous use, and also all the way
and run off on and above said location

4. The amount of groundwater claimed (in miner's inches or gallon
 per minute) 10 gallons

5. If used for irrigation, give the acreage and description of the land
 to which water has been applied and name of the owner thereof.
about one (1a) of home garden, and
lawm.

Ray M. Le Count

6. The means of withdrawing such water from the ground and the
 location of each well or other means of withdrawal.
With elec. pump, since 1937

7. The date of commencement and completion of the construction of the well, wells, or other works for with-
 drawal of groundwater one in 1893
one in 1949

8. The depth of water table. 20' to 60" ?

9. So far as it may be available, the type, size and depth of each well or the general specifications of any other
 works for the withdrawal of groundwater.

one Drilled 2" casing 90' in 1893

one Drilled 6" casing 90' in 1949

10. The estimated amount of groundwater withdrawn each year. 1825000 gallons

11. The log of formations encountered in the drilling of each well if available.

Drilled to the Second Cat Creek sand.

12. Such other information of a similar nature as may be useful in carrying out the policy of this act, including
 reference to book and page of any county record.

Signature of Owner

Ray M. Le Count

Date

Dec 18 1963

Three copies to be filed by the owner with the County Clerk and Recorder of the county in which the well is
 located.

Please answer all questions. If not applicable, so state, otherwise the form will be returned.

Original to the County Clerk and Recorder; duplicate to the State Engineer; Triplicate to the Montana Bureau
 of Mines and Geology, and Quadruplicate for the Appropriator.

Appendix B. Logs of test borings drilled at the Sanitation, Inc. landfill, Lewistown, Montana.

Boring Name: SI-1		Location of Boring: Sanitation, Inc. Landfill, Lewistown, Montana	
Date: 11-11-81		Drilled by: [illegible]	
Depth: 100 feet		Log by: [illegible]	
Boring No. 100		Remarks:	
0	0	[illegible]	
10	10	[illegible]	
20	20	[illegible]	
30	30	[illegible]	
40	40	[illegible]	
50	50	[illegible]	
60	60	[illegible]	
70	70	[illegible]	
80	80	[illegible]	
90	90	[illegible]	
100	100	[illegible]	

Boring Name: SI-1

Job Number: 93-51

Client: Sanitation, Inc.

Date: unknown

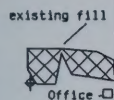
Drilling Method: Air Rotary

Drilling Firm: unknown

Total Depth: 155 ft.

TOC Elevation:

Geologist:

Damschen & Associates, Inc.
Helena, Montana**Well Construction
Details**

L

Depth

Graphic
Log

Description

5

tan sandy siltstone, moderately well-lithified; cuttings show slightly higher sand content with depth

10

15

20

grey clay shale

25

interbedded sand and silt, with sand fraction increasing w/ depth

30

predominately fine-grained tan sand with significant silt fraction

35

40

tan sandy siltstone

45

50

4140

4135

4130

4125

4120

4115

4110

4105

4100

4095

Boring Name: SI-1

Job Number: 93-51

Client: Sanitation, Inc.

Date: unknown

Drilling Method: Air Rotary

Drilling Firm: unknown

Total Depth: 155 ft.

TOC Elevation:

Geologist:

Damschen & Associates, Inc.
Helena, Montana**Well Construction
Details**

existing fill



L

Depth

Graphic
Log

Description

55

grey clay shale

60

65

70

greyish green calcareous sand and silt, fining with depth

75

80

greyish green calcareous silt

85

very fine-grained silty sandstone

90

greyish green sand, very fine-grained, calcareous

95

tan sandstone, well-lithified, some thin bedding planes visible in cuttings

100

4090

4085

4080

4075

4070

4065

4060

4055

4050

4045

Boring Name: SI-1

Job Number: 93-51
Client: Sanitation, Inc.
Date: unknown
Drilling Method: Air Rotary
Drilling Firm: unknown
Total Depth: 155 ft.
TOC Elevation:
Geologist:

Damschen & Associates, Inc.
Helena, Montana

**Well Construction
Details**

existing fill



Depth

Graphic
Log

Description

105

110

115

120

125

130

135

140

145

150

rust to maroon clay shale

grey clay shale

rust to maroon clay shale; driller injected water (verbal
communication, landfill operator)

4040

4035

4030

4025

4020

4015

4010

4005

4000

3995

Boring Name: SI-1

Job Number: 93-51

Client: Sanitation, Inc.

Date: unknown

Drilling Method: Air Rotary

Drilling Firm: unknown

Total Depth: 155 ft.

TOC Elevation:

Geologist:

Damschen & Associates, Inc.
Helena, MontanaWell Construction
Details

existing fill



L

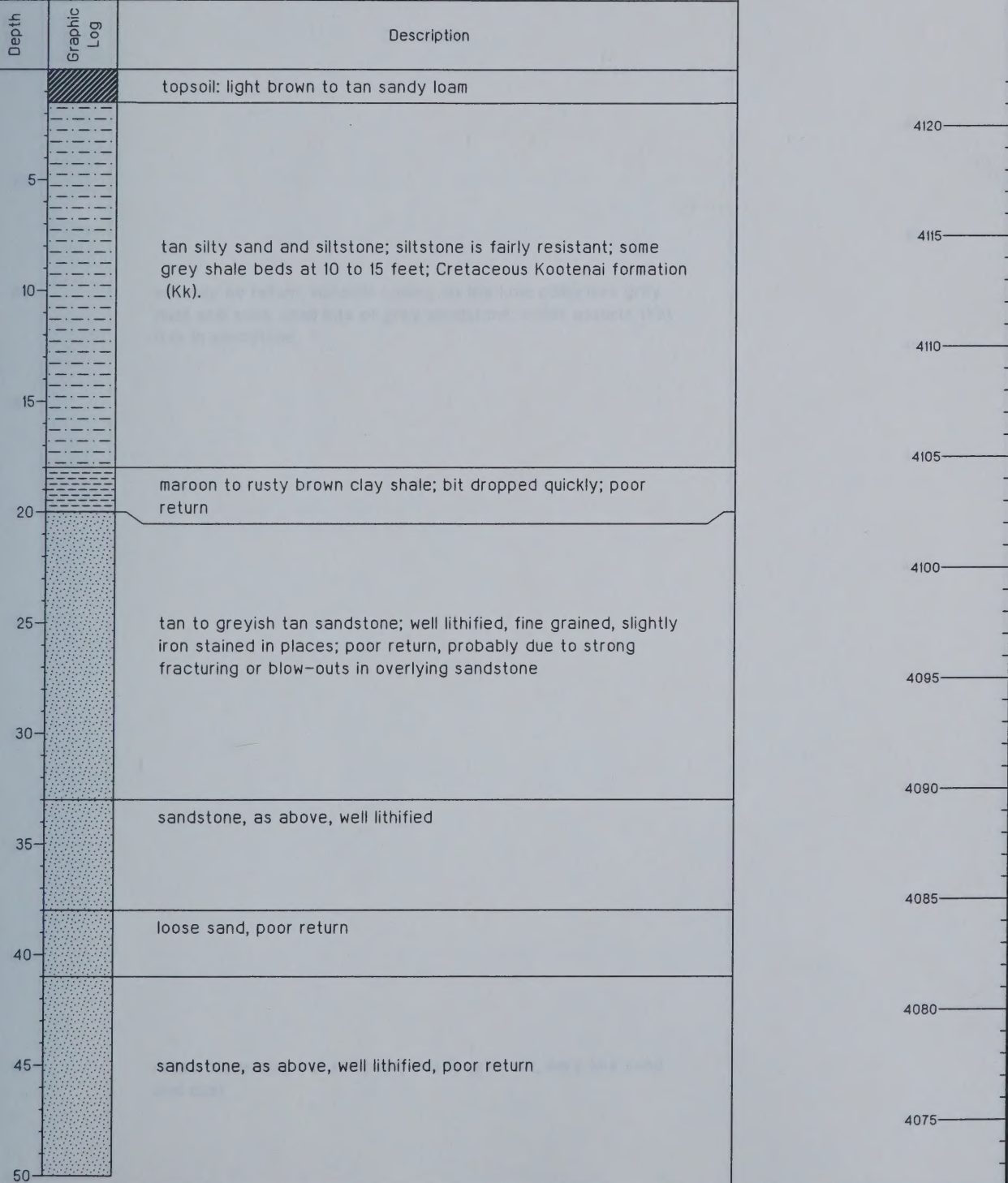
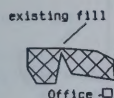
Depth	Graphic Log	Description	
155			3990
160			3985
165			3980
170			3975
175			3970
180			3965
185			3960
190			3955
195			3950
200			3945

Boring Name: SI-2

Job Number: 93-51
 Client: Sanitation Inc., Spoja
 Date: 10/5/93
 Drilling Method: Air Rotary
 Drilling Firm: Four Star Drilling, Lewistown
 Total Depth: 220 ft.
 TOC Elevation:
 Geologist: Siegmund

Damschen & Associates, Inc.
 Helena, Montana

Well Construction Details



Boring Name: SI-2

Job Number: 93-51

Client: Sanitation Inc., Spoja

Date: 10/5/93

Drilling Method: Air Rotary

Drilling Firm: Four Star Drilling, Lewistown

Total Depth: 220 ft.

TOC Elevation:

Geologist: Siegmund

Damschen & Associates, Inc.
Helena, Montana**Well Construction
Details**

existing fill



Depth

Graphic
Log

Description

55

60

65

70

75

80

85

90

95

100

virtually no return; material coming up the hole comprises grey dust and some small bits of grey sandstone; driller asserts that it is in sandstone.

return increasing but still poor; mostly grey silt, very fine sand and dust

4070

4065

4060

4055

4050

4045

4040

4035

4030

4025

Boring Name: SI-2

Job Number: 93-51

Client: Sanitation Inc., Spoja

Date: 10/5/93

Drilling Method: Air Rotary

Drilling Firm: Four Star Drilling, Lewistown

Total Depth: 220 ft.

TOC Elevation:

Geologist: Siegmund

Damschen & Associates, Inc.
Helena, Montana**Well Construction
Details**

existing fill



Depth	Graphic Log	Description	
		no return	4020
105		poor return	
110		dust blowing out of hole changes from grey to rusty red and maroon; probably maroon clay shale of Kk	4015
115			4010
120			4005
125		very little return, mostly maroon shale	4000
130			▽ 3995
135			3990
140			3985
145		dust changes to grey; possibly grey sandstone	3980
150			3975

Boring Name: SI-2

Job Number: 93-51

Client: Sanitation Inc., Spoja

Date: 10/5/93

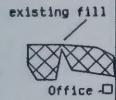
Drilling Method: Air Rotary

Drilling Firm: Four Star Drilling, Lewistown

Total Depth: 220 ft.

TOC Elevation:

Geologist: Siegmund

Damschen & Associates, Inc.
Helena, Montana**Well Construction
Details**

Depth	Graphic Log	Description	
155			3970
160		very poor return; maroon dust to about 170 feet	3965
165			3960
170		very poor return; grey dust to 180 feet	3955
175			3950
180		no return	3945
185		grey dust; possibly grey sandstone	3940
190		maroon shale; poor return, but some cuttings recovered	3935
195		clearly encountering moisture in maroon clay shale by 190'	3930
200			3925

Boring Name: SI-2

Job Number: 93-51

Client: Sanitation Inc., Spoja

Date: 10/5/93

Drilling Method: Air Rotary

Drilling Firm: Four Star Drilling, Lewistown

Total Depth: 220 ft.

TOC Elevation:

Geologist: Siegmund

Damschen & Associates, Inc.
Helena, MontanaWell Construction
Details

existing fill



Depth

Graphic
Log

Description

205

poor return, possibly sandstone

210

215

no return

220

total depth = 220 feet; production estimate impossible due to lack of return; static water level rose to 128 feet; hole plugged with 26 bags of 3/8' Hole-Plug brand bentonite pellets.

225

230

235

240

245

250

3920

3915

3910

3905

3900

3895

3890

3885

3880

3875

Boring Name: SI-3

Job Number: 93-51

Client: Sanitation, Inc., Spoja

Date: 10/6/93

Drilling Method: air rotary

Drilling Firm: Four-Star Drilling, Lewistown

Total Depth: 200 ft.

TOC Elevation:

Geologist: Siegmund

Damschen & Associates, Inc.
Helena, MontanaWell Construction
Details

existing fill

Office

Depth

Graphic
Log

Description

becomes less arenaceous with depth

grey-green shale

red to maroon clay shale interbedded with grey shale and grey green shale

yellow fine-grained sand and grey silt

grey-green, medium-grained sandstone, well indurated

loose sand and silt ranging in color from rust to grey-green

grey-green, fine-grained silty sand with some rust zones and thin silty clay beds; becomes finer with depth to sandy silt and clay

4045

4040

4035

4030

4025

4020

4015

4010

4005

4000

Boring Name: SI-3

Job Number: 93-51

Client: Sanitation, Inc., Spoja

Date: 10/6/93

Drilling Method: air rotary

Drilling Firm: Four-Star Drilling, Lewistown

Total Depth: 200 ft.

TOC Elevation:

Geologist: Siegmund

Damschen & Associates, Inc.
Helena, Montana**Well Construction
Details**

existing fill

Office

Depth

Graphic
Log

Description

105

110

115

120

125

130

135

140

145

150

light grey argillaceous sandstone

maroon shale

dark grey clay shale

maroon shale punctuated by thin strata of sandy grey-green shale

hard, sandy grey-green shale

maroon shale

sandy, grey-green shale

maroon shale

grey-green shale

well-indurated, shaley, grey-green sandstone, poor return at 150 feet

3985

3990

3985

3980

3975

3970

3965

3960

3955

3950

Boring Name: SI-3

Job Number: 93-51
Client: Sanitation, Inc., Spoja
Date: 10/6/93
Drilling Method: air rotary
Drilling Firm: Four-Star Drilling, Lewistown
Total Depth: 200 ft.
TOC Elevation:
Geologist: Siegmund

Damschen & Associates, Inc.
Helena, Montana

**Well Construction
Details**

existing fill



Depth	Graphic Log	Description	
155		maroon shale	3945
160		hard, grey, sandy shale and shaley sandstone, poorly indurated and more argillaceous approaching 160 feet	3940 ▽
165		no return	3935
170		maroon shale, variably lithified	3930
175		sticky red and maroon shale	3925
180		no return; injected water to clear hole; mostly sticky shale blown out; saturated at 185'	3920
185			3915
190			3910
195			3905
200		dark grey, limey (?) shale, very hard	3900

Boring Name: SI-4

Job Number: 93-51

Client: Sanitation, Inc., Spojia

Date: 10/6/93

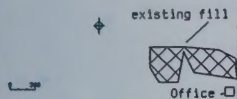
Drilling Method: Air Rotary

Drilling Firm: Four Star, Lewistown, MT

Total Depth: 200 ft.

TOC Elevation:

Geologist: Siegmund

Damschen & Associates, Inc.
Helena, Montana**Well Construction
Details**

Depth	Graphic Log	Description	
		tan silty loam	
		yellowish-tan sandy silt	4070
5			
			4065
10			
			4060
15			
			4055
20		rusty, sandy silt	
		greyish-tan silt grading to dark grey and black shale	4050
25			
			4045
30			
			4040
35		yellow sandy silt interbedded with grey sandy silt	
			4035
40		grey-green silty sandstone with a few yellow sand/silt beds	
			4030
45			
			4025
50			

Boring Name: SI-4

Job Number: 93-51

Client: Sanitation, Inc., Spojia

Date: 10/6/93

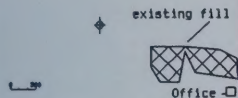
Drilling Method: Air Rotary

Drilling Firm: Four Star, Lewistown, MT

Total Depth: 200 ft.

TOC Elevation:

Geologist: Siegmund

Damschen & Associates, Inc.
Helena, Montana**Well Construction
Details**

Depth	Graphic Log	Description	
55			4020
60		grey-green silty sandstone with intercalated beds of rusty yellow sandy silt; yellow silt strata are less than a foot thick and occur every three to five feet	4015
65			4010
70			4005
75			4000
80			3995
85		maroon shale	3990
90			3985
95			3980
100			3975

Boring Name: SI-4

Job Number: 93-51

Client: Sanitation, Inc., Spoja

Date: 10/6/93

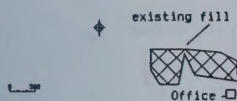
Drilling Method: Air Rotary

Drilling Firm: Four Star, Lewistown, MT

Total Depth: 200 ft.

TOC Elevation:

Geologist: Siegmund

Damschen & Associates, Inc.
Helena, MontanaWell Construction
Details

Depth	Graphic Log	Description	
105			3970
			3965
110			3960
		maroon shale with widely scattered strata of grey-green sand and silt	3955
120			3950
			3945
130			3940
			3935
140			3930
		grey sandy silt and silty sand, some loss of return; yellowish in color from 153 to 154 feet	3925
150			

Boring Name: SI-4

Job Number: 93-51
Client: Sanitation, Inc., Spojia
Date: 10/6/93
Drilling Method: Air Rotary
Drilling Firm: Four Star, Lewistown, MT
Total Depth: 200 ft.
TOC Elevation:
Geologist: Siegmund

Damschen & Associates, Inc.
Helena, Montana

**Well Construction
Details**

Depth	Graphic Log	Description	
155			3920
160		grey sandy silt over hard, CaCO ₃ -cemented argillaceous sandstone, yellowish green in color	3915
165		sandy grey silt	3910
170			3905
175			3900
180			3895
185			3890
190		maroon shale interbedded with thin strata of grey silt and silty clay	3885
195		slightly sticky	3880
200			3875

